

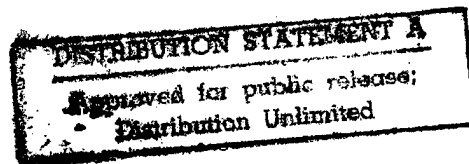
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# East Europe Report

SCIENCE AND TECHNOLOGY



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2 May 1985

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INTERNATIONAL AFFAIRS

RUNDOWN ON BLOC, POLONIA COMPUTER EXHIBITS AT POZNAN FAIR

Warsaw INFORMATYKA in Polish No 10, Oct 84 pp 25-29

[Article by Jacek Zebrowski: "The 56th Poznan International Fair; More and More Computer Science"]

[Text] The products exhibited at the fair represented a very objective reflection of our technical ideas. Thanks to the Poznan exhibit, one can evaluate the level of Poland's technology with a certain amount of accuracy. However, it is very difficult to evaluate the economic side of production. I believe that the 56th fair was a meeting that was well-rooted in reality. Therefore, let us review the exhibits.

All of the data listed below are derived from material provided by the exhibitors.

The Offerings of Poland's Computer Industry

Poland's hardware and software manufacturers appeared under the MERA tradename. MERA is the Association of Producers of Information Science, Automation and Measuring Equipment, grouping together 24 industrial enterprises, including 11 involved exclusively with information science. This year's MERA exhibit was located in pavilions 38/38A and 19. The exhibit area covered a larger area than in previous years, which greatly improved service operations and visiting conditions. The following teleprocessing equipment dominated the exhibit:

- the EC 1032M computer system;
- the EC 8371.01 teleprocessing processor;
- the EC 8578 subscription station;
- the FSPD90-CM 6904 station;
- the MERA 9150 terminal;
- the MST 8000 terminal system.

In addition, the following well-known devices were exhibited:

- the SM-4 minicomputer;
- the MERA 60 minicomputer;
- the ELWRO 513 microcomputer.

The MERA-ELZAB (Zabrze) Computer Equipment Plants presented:

--A system to aid in the design and implementation of RTOS-8 type microsystems (it was described in INFORMATYKA No 1/83 p 5). This system was nominated for the Poznan International Fair Gold Medal.

--The MERA 7953N CRT [cathode ray tube] monitor (CM 7209), which is designed for operation in microcomputer systems. It has a programmable keyboard with a separate numeric pad and cursor control that meet ANSI and GOST standards. The high resolution CRT screen measures 15" diagonally. The CRT can display 24 lines of up to 80 characters per line. The characters are formed by a 5 x 7 dot matrix. The 7953N also includes a V.24 modem interface (S2 connector) and 20/60 mA current loops (IRPS). It operates with ASCII (ISO-7) code. Transmission rate is selectable from 75 to 9600 bauds.

--The MERA 7978 CRT monitor is a terminal designed for large computer systems. It is compatible with the IBM 3278 monitor models 2 and 13. It has a high resolution 15" (diagonal) screen. It can display 24 lines of 80 characters or 32 lines of 80 characters plus a system line. Its set of characters numbers 256, which are formed on the screen by a 9 x 12 dot matrix. The keyboard is programmable. Synchronous transmission is via a coaxial cable at a speed of 2.4 MB/s.

--The ComPAN-8 microcomputer for professional applications is based on the 8085 microprocessor. Its main memory consists of a 64 KB RAM and a 8 KB ROM. This memory is expandable to 1 MB divided into 64 KB pages which, in turn, can be divided into 16 KB blocks. The system contains an 8" floppy disk memory and a dot matrix printer permitting graphic or keyboard presentations. The built-in monitor with a separate graphics memory permits characters and graphics to be displayed (200 lines x 640 dots). The screen can be divided into fields and the display can be scrolled. Parallel and serial connectors permit system expansion. Specialized I/O modules are projected. Software is based on the CP/M 2.2 or ISISII operating systems. Editors, assemblers (8080 and Z80) as well as compilers and interpreters for BASIC, FORTH, PASCAL, PL/M and FORTRAN are available. Memory expansion makes it possible to create a semiconductor disk, which speeds up the operation of the entire system and enables the use of a multitasking operating system.

--The MERITUM I personal computer, whose development was spearheaded by the ITM Polonia Enterprise, is the first model of the MERITUM family of microcomputers. It has a 14 KB ROM and a 16/17 KB RAM. It uses the Z80 microprocessor. It has a 1 KB graphics memory. It can display 16 lines of up to 64 characters each or 16 lines of up to 32 characters, or 48-line semigraphics of 128 dots per line. It has a standard keyboard housed within

the same unit as the microcomputer itself. It generates an audio signal confirming the input of a character. Serial and parallel connections are available. It should be emphasized that its I/O systems are quite extensive for this type of computer. A buffered bus and programmable counters (permitting, for example, the creation of a real-time clock) permit the MERITUM to be used as a simple controller. The unit also contains a tape recorder cassette as an external memory. An ordinary TV receiver or specialized monitor, for example, a Neptune 156, can be connected to the unit. The MERITUM I uses an expanded version of BASIC software, similar to MICROSOFT. To a certain extent, MERITUM reminds one of the popular TRS-80 personal computer. It should be emphasized that MERITUM's design is based on electronic components available in the CEMA countries, and it is inexpensive.

The next model, the MERITUM II, will have a 64 KB main memory as well as floppy disk memories with a CP/M operating system. Readers can find more details on MERITUM in the article by Z. Korga, A. Smolinski, J. Lipowski and P. Posiadlo in BIULETYN TECHNICZNO-INFORMATYCJNY MERA No 10/83, and in the article by Z. Korga in BIULETYN No 5-6/84.

The MERA-STER Scientific and Production Center for Control Systems (Katowice) exhibited:

--A MERA 60 microcomputer that, thanks to emulation, can operate as an intelligent terminal in computer networks with a RIAD or IBM 360/370 central computer. An RT 60 V.04 operating system and transmission software that is compatible with the BSC protocol are essential. The MERA 60, together with additional MERA 7953 monitors, can function as an IBM 3270 interactive terminal or as an IBM 3780 batch terminal.

--The 16-bit MERA 60-84 microcomputer that is hardware and software compatible with the MERA 60. A VT05 operating system is required. This version consists of a central processing unit containing in a single package a processor, a 56 KB memory, a bootstrap, controllers for a printer and a CRT, and a floppy disk memory. Additional packages can be added. A 4.7 MB hard disk (for example, the MERA 9450), a CRT monitor and a dot matrix printer (for example, the D-100) are essential.

The ERA Factory for Measuring Instruments and Computers (Warsaw) exhibited SM-type systems with an Elektronika 100-25 or SM-2104 processor.

The MERA-Blonie Precision Mechanisms Plants presented:

--The D-200 dot matrix printer (described in INFORMATYKA No 9/83 p 25).

--The D-100 dot matrix printer, which is a modern, small (410 x 320 x 120 mm), light (about 12 kg) and inexpensive desktop printer controlled by a microprocessor and powered by stepper motors. It uses standard 10"-wide or narrower (from 4" to 9.5") margin-perforated paper. Regular paper, roll or sheet, up to 8.5" wide can also be used. It has a 10-needle print-head. Horizontal printout density is 10, 12 or 15.5 characters per inch. Vertical printout density is 6, 8 or 10 lines per inch. The "I" (intelligent) version can provide various print types: normal, wide, uppercase, boldface,

doublestrike or their combinations. Semigraphics or point graphics can be printed. Many of the microcomputers displayed at this year's fair were actually equipped with this printer. It can be assumed that the D-100 will be used extensively very shortly.

--The MIXS TP minisystem is a modular and multiprocessor system designed to process text and graphics. It employs a MIXS GD graphics raster monitor and a MIXS MP graphics dot matrix printer. This equipment is equipped with hard and floppy disk drives, a large keyboard, a V.24 communications interface and the capability of operating in the Ethernet local network.

The Krakow MERA-KFAP Measuring Equipment Factory exhibited:

--The ED 501 D and ED 502 D floppy disk memory units (they were described briefly in INFORMATYKA No 9/83 p 28).

--The SP 55 DE (SM 5608) 8" floppy disk memory for SM-3 minicomputer systems based on the so-called common bus. The memory can also operate with with a PDP 11/05 minicomputer.

--The SP 60 M floppy disk memories for Elektronika 60 minicomputers and possibly for the PDP 11/03.

--The MK-45 minicomputer based on the 8085 microprocessor with a 48 KB main memory. In addition to a keyboard, it has a CRT monitor that can display 24 lines of up to 80 characters per line, a floppy disk memory unit, and a dot matrix printer. The IMPS operating system (corresponding to the known CP/M 1.4 operating system) permits the use of a FORTRAN and BASIC microassembler and BSC communications software.

The Warsaw MERAMAT Information Science Equipment Plants exhibited:

--A PK-3 (CM 5214) small cassette memory with an SM interface. It fits in a Eurocard-size cassette. Recording is according to the ISO 3407 standard for compact-type cassettes (90 m long by 3.81 mm wide tape) using the dual-track PE method. Recording speed is 254 mm/s and search speed is 1 m/s. Recording density is 32 bits/mm. Power requirements are +5 V, -5V and +12 V. It weighs about 1.5 kg.

The CEKAR Center for Computerizing the Marketplace (Warsaw) displayed microcomputer-based cash registers, repeating their displays of last year (INFORMATYKA No 9/83 p 28).

Among enterprises involved primarily with software, MERA-SYSTEM (Warsaw), ZETO-ZOWAR (Warsaw), ZETO Katowice and ZETO Wroclaw had exhibits. In general, they offered software for large computer systems or minicomputers. Microcomputer systems were shown in their advertisements, but they were only very specialized systems for specific applications.



ZETO Lodz offered general-use software for microcomputers in the form of a library of software for Pitem microcomputers and an interactive system for compiling and implementing microprocessor programs that are written in PL/M-80.

#### The Offerings of Polish Science

A separate, large and coherent exhibit was displayed by several hundred exhibitors from the PAN [Polish Academy of Sciences], the higher schools, industrial institutes and industrial research and development facilities. Most exhibitors presented specific microcomputer applications, especially regarding automation of measurements, data collection, and equipment control. They were specialized solutions addressed to a narrow, specific band of customers.

Two original organizational forms are noteworthy:

--With the cooperation of the KEBA Polonia Enterprise (Warsaw), the Warsaw Center of the Student Scientific Movement offered services related to programming computers, including designs for industrial information systems.

--The PAN Science Trade Office (Warsaw, 2 Miodowa Street, tel 26-85-86) advertised civil information services companies offering software.

#### Offerings of Polonia Firms.

Most of the Polonia firms attending this year's fair participated in the joint exhibition organized by the Polish-Polonia Chamber of Industry and Commerce. I estimate that about 10 percent of the Polonia exhibitors presented offerings related to information science. But this group was not uniform. It can be divided into two parts:

--Firms whose information science products are not directed primarily to a specific customer, and thus are mass produced.

--Firms whose information science activities are related to specific applications and whose products are specialized, that is, made to individual order.

In both cases, the use of modern electronic components from the Western countries is characteristic. In association with this, one should remember the fact that the activities of Polonia enterprises in the area of information science are most often linked with market production (lamps, toys and the like).

A review of their exhibits is as follows:

The AMEPROD Foreign Enterprise (Poznan) exhibited:

--A module to expand the popular Sinclair ZX81 microcomputer system, increasing its capabilities significantly. They are:

--the AC 501, which expands main memory to 48, 52 or 56 KB;

--the AC 502, a high-resolution graphics module that permits the display on a CRT of a picture containing 248 x 192 dots. It requires a main memory of at least 16 KB and contains its own program in permanent memory ( 2 KB). A single page display requires about 6.2 KB.

--the AC 503 is a CENTRONICS standard parallel interface module. It has its own program in a permanent 1 KB memory. It uses the ASC II character code, and it permits a standard and high resolution display to be copied with the aid of a Seikosha GP-100A printer.

--the AC 101 is a cassette that permits the use of the three modules described above. It also has a "reset" key, the absence of which was keenly felt on the ZX 81.

--The ZLA-01 is a single-board laboratory microcomputer that uses the 8080 family of integrated circuits. It permits the user to calculate simple functions and run a few programs. It also includes a special textbook to conduct classroom projects in microprocessor technology. It uses an MCY 7880 microprocessor, an EPROM memory containing a 2 KB monitor program, a 2 KB user memory, a 1 to 2 KB RAM, and serial and parallel interfaces. The equipment is based on the Multibus bus. It contains a 25-key keyboard as well as optical and audio signaling. Additional modules can be added to the system: I/O, memory, a printer interface and logic status analyzer.

--The AC-805 personal computer is a universal microcomputer designed for engineering calculations, automation of laboratory work, teaching microinformatics and as an intelligent terminal. It provides extensive capabilities for adding external equipment: a programmed universal 24-bit parallel port and two RS232C serial interfaces. The TV-type CRT monitor displays 24 lines of up to 32 characters per line--a total of 96 ASC II characters and 32 graphics symbols are available. It is possible to expand programatically the repertoire of characters by 128. The AC-805 is equipped with a BASIC interpreter corresponding to the MICROSOFT version. It uses a Z80 microprocessor, a 12 KB ROM and a 16, 32 or 48 KB RAM. It records on magnetic tape using FSK technology at a speed of 300 or 1200 bauds. Its dimensions are 350 x 400 x 90 mm. It has a standard keyboard.

--The bigger systems, based on the AC-805, require the connection of disk memories:

--a model 915 controller for four 5 1/4" floppy disks, each disk having a 500 KB capacity;

--a model 925 controller for a Winchester-type 30 MB rigid disk unit.

AMEPROD uses Seikosha printers.

The APINA Foreign Enterprise (Zielona Gora) presented:

--A CPO-1 type digital graphics memory. It is designed to record a TV picture. The recorded TV picture can be duplicated on a TV monitor. The system is equipped with means to record and play back information slowly to permit the picture to be recorded on a tape recorder. The TV signal is a standard 1 V peak-to-peak signal across 75 ohms. Picture resolution is 256 x 256 dots, and each dot can have 1 of 16 levels of greyness.

The CAREX Foreign Enterprise (Warsaw) presented:

--A CA X-5000 type plotter (autoplotter) that uses modular construction and exchangeable interfaces. The use of a microprocessor permits specialized software to be located in the plotter. Because of this, individual instructions controlling the pen permit the execution of repeatable portions of a graph, for example, coordinate systems, scales or legends. The working area of the plotter has an A4 format. Four colors can be selected programatically. The plotter is powered by stepper motors. The smallest addressable step is 0.1 mm and the repeatability is better than 0.1 mm (without changing pen tips) and better than 0.2 mm with changing pen tips.

The COMPUTEX Enterprise (Warsaw) presented:

--The CS-80 microcomputer (described in INFORMATYKA No 9/83 p 31).

--The INDUSTRIAL REAL TIME BASIC programming language (described in INFORMATYKA No 9/83 p 31).

--Semiconductor memories for various types of computers and minicomputers.

--The CS-305 microcomputer that permits a user to continue work initially done on a MERA 305 minicomputer.

--The CS-101 plotter, also called COMLOTTER (a new item!). It is powered by stepper motors and can provide A3 format drawings. The smallest step size is 0.1 mm. Position repeatability is 0.1 mm without changing the writing element and 0.2 mm with changing the writing element. A CENTRONICS or LOGABAX-type parallel interface is proposed.

The DIGICOM-POLAND Enterprise (Warsaw) offered:

--Microcomputer systems to control technical equipment programatically.

--Inductive and capacitive position sensors for control systems.

The IMPOL I Enterprise (Warsaw) presented:

--The MSM modular microprocessor system (described in INFORMATYKA No 2/83 p 17 and No 9/83 p 31).

--The modular MPC personal computer designed for engineering and office work, scientific research, automation of laboratory data collection and control functions. Its modular design permits system expansion as user needs increase. It contains an Intel 8085A microprocessor, an 8 KB to 64 KB RAM, and a 8 KB to

16 KB ROM. The CRT monitor displays 25 lines of 80 characters per line for text or 200 lines x 640 dots for graphics with scrolling capability. The MSM modules are used with the Busmat bus. Its MSM-MOPS-E operating system program is encoded in an EPROM along with utility programs and a BASIC interpreter. A disk operating system, corresponding to the CP/M and ISIS II systems, is projected.

The IMPOL II Enterprise (Warsaw) presented:

--A Business-micro class microcomputer with floppy disk memory and an IMPS operating system corresponding to the CP/M system. The entire system, called the IMP-85, was described in INFORMATYKA No 9/83 p 32.

--A TLSA-10 type adapter that is used to multiply a V.24 parallel interface. A typical application is to use it to connect up to 10 terminals to a large computer through one modem (and one telephone line). The terminals, for example, can be IMPOL II terminals, designated as IMP8502. The equipment operates in full duplex. It also can transmit synchronously with an asynchronous modem.

--A microprocessor telex adapter, the so-called MAT-1 TELEX-BOX. This device is used to connect computers equipped with serial interfaces to a telex line. The MAT-1 output, which connects to a telex line, is compatible with CCITT specifications. The MAT-1 input, which is connected to the computer, is compatible with a standard serial interface. An additional V.24 interface permits a printer, for example, to be connected. Transmission speed can be from 75 to 19,200 bauds. In light of the different transmission speeds in the telex line and the V.24 interface, a 4 KB buffer memory is used. This adapter permits remote access to a computer from any telex. A telex line can be used to communicate between computers and a computer can be used as an intelligent telex station, which permits, for example, correspondence to be sent and received.

The ITM Enterprise (Krakow) presented:

--A startup system using a Z80 microprocessor that is based on the CAMAC system and is equipped with software that is similar to the CP/M operating system.

--An industrial controller, based on the 8080 microprocessor, that is used to control machines and equipment. A special language is used, facilitating the design of a control program. The controller handles up to 512 I/O channels.

--A portable (briefcase size) device, called the ADCS-7C, to collect analog data. It has a 7-channel, 8-bit A/D converter whose processing time is 100  $\mu$ s/channel. The sampling period is 2 ms to 1 s. Measurements are recorded in a RAM and then on audio tape. This permits the tape to be read later by a MERITUM computer. Thus, measurements can be made in the field and then processed at home on a computer using one's own or the firm's software.

The CSK Kajkowski Computer Studio (Gdynia), defining its activities as "production of microcomputers and software and informatics consultation," specializes in computer graphics problems. The firm's advertisement was placed in INFORMATYKA No 4/84 and 5/84. In brief, their offerings consist of:

- expanding BASIC to include graphics instructions;
- utility software to create three-dimensional graphics;
- software to record source documents digitally;
- a system to aid in designing printed circuits;
- a system to aid in drawing mechanical drawings;
- a program to edit text, with a plotter as the printing device;
- the CSK DATA BANK relative data management system;
- a packet to prepare plans, specifications and reports and to produce TEKST-CSK text and programs.

I believe that the Polonia firms are well aware of the weaknesses of the large MERA computers. These small, dynamic firms quickly fill in the gaps as they appear. A good example of this is the CRT monitors that are offered by the Polonia firms at almost twice the price of the ZUK-Zabrze monitor, but at least these Polonia monitors can be obtained in a reasonable time frame. Similarly, to supplement the small operating memories in the computers and minicomputers supplied by Polish industry, at least three Polonia firms (AMEPOL, COMPPUTEX and DANPOL) are offering large-capacity memory modules for the ODRA 1305, R-32, MERA 400, MERA 9150, Nova 840 and Nova 1200 computers. I heard that they are also eagerly offering memories for SM computers. As I already mentioned, the MERITUM personal computer is the result of direct collaboration between Polonia firms and state industry.

#### CEMA Country Offerings

##### Bulgaria

The Bulgarian industry presented:

--An ISOT 0206 basic microcomputer system combined with a CAMAC system. It is designed to gather data, control equipment (for example, technological equipment), automate engineering work and scientific investigations and the like.

--The ISO7 2104C minicomputer system, which is a multistation system for the inputting and initial processing of data, is equipped with EC 9005 CRT monitors.

--An EC 5074 8" floppy disk memory unit. It uses the single-sided, double-density recording method. Each disk has a capacity of 3.2 MB, and the data transfer rate is 250 Kbits/s.

--An EC 5082 8" floppy disk memory unit with increased recording density. The FM/MFM recording method is used. Its parameters are double those of the EC 5074. Both memory types use single-sided disk recording.

--An EC 5088 5 1/4" floppy disk memory unit. It uses the single-sided, double-density recording method. Disk capacity is 109.4 KB, and the data transfer rate is 250 Kbits/s. The disk rotates at a speed of 300 revolutions/min. Power input is +12 V at 0.8 A and +5 V at 0.5 A. It weights about 2 kg.

--An ISOT 5050E floppy minidisk memory unit with double density recording. Disk capacity is 218.8 KB, and the data transfer rate is 250 Kbits/s. It uses the single-sided FM/MFM recording method. It has 35 tracks. Mechanical parameters and power input are similar to the EC 5088.

--An "if 800" series desktop computer. This design is the result of Bulgarian access to advanced technology and was made possible thanks to, among other things, the cooperation with Oki, a Japanese firm. The equipment's parameters place it in the world class. It uses a Z80 processor, a main memory having a capacity of up to 256 KB, and a 2 MB floppy disk memory. The CRT monitor displays 25 lines of up to 80 characters per line or 400 lines with 640 dots. Each picture dot can be programmed in eight colors. It has a video RAM with a capacity of up to 96 KB. The computer contains a built-in dot matrix printer. Various types of I/O equipment can also be connected. For example, a plotter or modem can be connected via the serial interfaces. The computer is equipped with the CP/M operating system and a very extensive library of programs, numbering over 100 items.

#### Czechoslovakia

Czechoslovakia did not exhibit any computer equipment this year. The KOVO commercial enterprise exhibited various electronic components and subassemblies, including some that are very useful in microsystem designs.

#### GDR

A S6010 electronic typewriter (with a V.24 interface) was the only item exhibited at this year's fair.

#### Romania

In previous years, this country did not exhibit computer equipment or advanced electronics. Therefore, this year's offerings by ELECTRONUM (a Bucharest computer equipment export enterprise) were a surprise. The characteristics of the more important exhibits are as follows:

--An ECAROM 880 microcomputer to control and monitor technological processes that is based on the Eurokart standard.

--THETA ROM FD 5010 equipment for automatic testing of TTL and CMOS integrated circuits that is based on a FELIX M-18 minicomputer.

--The ISM 150 dot matrix printer.

--The VDT 40C alphanumeric monitor, equivalent to DEC's VDT 52 monitor.

--The DAF 2020 CRT monitor, equivalent to the TEKTRONIX 4010, that is capable of displaying 24 lines x 80 characters of text or 288 lines x 512 dots of graphics at a plotting speed of 15  $\mu$ s/dot.

--The DIAGRAM, a family of modular graphics systems suitable for independent operation or operation with a large computer. The system's architecture is based on two buses: a main bus and an I/O bus. Up to six processors can operate in the system. The I/O processor and the CRT operation processor, the vector generator, always perform. A dual graphics processor, an arithmetic processor and a Fourier processor can be connected to these systems. The model 2030 produces graphics having a resolution of 512 x 512 dots, but the model 2040 has a resolution of 1024 x 1024 dots with 8-bit color coding per dot. System memory is a 2 MB RAM. The disk memory capacity is 200 MB. The system is equipped with a full keyboard and a joystick. A graphics printer, light pen, interfaces for electronic equipment, for example, IEEE 483 type measurement equipment, fast D/A converters (50 ns--up to 8 bits) and A/D converters (200 ns--8 bits) can also be connected to the systems. A complete system operates under the supervision of a DIOS operating system. It permits control over 256 synchronous processes. Such languages as FORTRAN, LISP, and EDISON can be used. Thanks to its microprogramming capabilities, a "BASIC computer" can be emulated, permitting programs written in BASIC to be executed rapidly. The graphics module is a subset of the SIGGRAPH standard.

--The M-216 computer, which is a 16-bit machine using the 8086 microprocessor. (It aroused so much attention that on the second day of the fair it was impossible to obtain a data sheet.)

#### Hungary

The Hungarians exhibited:

--A type 52121 raster graphics monitor.

--A type VT20/IV small computing system with four workstations (briefly described in INFORMATYKA No 9/83 p 27).

--An MF 6400 5 1/4" floppy disk memory unit. Disk capacity is 109.4 KB. Data transfer rate is 125 or 250 Kb/s. It uses the FM/MFM recording method. It has 35 tracks. The minidisk rotates at 300 revolutions/min. Power input is +12 V at 1.9 A and +5 V at 0.8 A. Its dimensions are 83 x 146 x 203 mm, and it weighs 1.5 kg. The unit is compatible with the SHUGART SA 400.

--A MINICOMP-C1 or "Transmic 8" personal computer (briefcase version). It is based on the Z80 processor and has a 512 Kb segmented memory. It contains two small floppy disk units. Total internal memory capacity is 1 MB. It contains a

built-in CRT monitor that can display 16 lines of 64 characters each. A M68000 16-bit microprocessor board can be added to the system. The computer is equipped with a real-time clock and permits an IEC-BUS bus to be connected. It also has a CENTRONICS parallel type interface to connect a printer and a serial interface to permit operation with computer networks. The software is compatible with software developed for the TRS-80 personal computer. Its operating systems are TRSDOS, NEWDOS and CP/M 2.2.

USSR

The USSR presented:

--A dual processor version of the SM 1300 minicomputer designed primarily to control technological processes.

--A mockup of the EC 1061 computer. According to the data, this model is the largest computer of the RIAD series and is capable of 1.5 million operations per second. It has an MB main memory. It can be connected to a mother processor.

\* \* \*

I believe that our 8-bit systems are in the very technically mature phase, and some of these systems are approaching the peak that can be achieved with an 8-bit word. We are now seeing the initial development of small 16-bit systems.

The state of Poland's electronic subassemblies base is very critical, even alarming, especially regarding large-scale integrated circuits. What difference does it make if the Polish 8080 won the Master of Technology award as long as a sensible microsystem cannot be constructed using Polish components? With regard to the difficulties in obtaining electronic components from the dollar-zone countries, the integrated circuits available from the CEMA countries have come to the rescue. However, to my knowledge none of our domestic microsystems is being produced today in large numbers.

I believe that it is not possible to purchase in Poland a ready-made single-board computer (SBC). It would have been possible to include it in various types of equipment, making the equipment "intelligent." Without this characteristic, nothing new can be built today that would meet the European level. Modular systems have their advantages, but they are large, complex and expensive. They do not solve the problem of extensive, simple and cheap applications of microcomputers. Single-chip microcomputers (for example, the 8048/8748/8035) are still not being used extensively, although their use in modern dot matrix printers is significant.

I have not noticed any greater activity in microcomputer software. On the one hand, one can see here an immense organization like ZETO, which is naturally interested in programming large and expensive systems that, I believe, have no concept of the future. On the other hand, there is Computer Studio Kajkowski, a small firm whose future is bright, that sells specific software. Between these two trends there are several average schemes, but for them software is



obviously a sideline to other activities. I would like to say here that the MERITUM project will be successful only if a lot of basic software will be available for this computer as well as utility programs (educational games, graphics, text editors and the like). In addition, sensible methods for distributing this software are necessary.

Many minicomputer and microcomputer users are complaining about the problems they are experiencing with service. Adjusting and repairing disk memories are the most serious problems. The supplier of the entire system often does not even want to be bothered about disk drives, and the disk drive producer is not interested in selling spare parts or entire units as spares. With regard to servicing these memories, the less said the better.

It is interesting that the Polonia firms are taking advantage of one of the weak points of the state computer industry by offering expanded main memories. However, I have not heard of anyone offering to repair hardware that he did not manufacture, especially peripheral equipment. The repair problem to date is not a public problem because of our country's low level of computerization. Despite being hampered by the weakness of our electronics industry and, to a certain extent, by the poor selection and high prices of software, the popularization of microcomputers must in the end occur. Then hardware repair will become a big problem.

Poland's microcomputer industry is closely following the path of development taken by the Western countries in this field. Are we able to take our path in this field? The next fair will provide the answer.

11899

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2 May 1985

## GERMAN DEMOCRATIC REPUBLIC

## SCIENTIST CRITICIZES CALL FOR INCREASED TECHNOLOGICAL RESEARCH

East Berlin SPECTRUM in German Vol 16 No 1, 1985 pp 8-11

[Discussion with Ulrich Hofmann, vice president, GDR Academy of Sciences, Werner Lange, member, GDR Academy of Sciences, Prof Dr Klaus Guenther and Prof Dr Eberhard Jobst, led by Joachim Moerke and Utz Hoffmann; date and place not specified]

[Text] SPECTRUM: Eleven years ago we conducted a discussion in our journal regarding the question whether technological research had "academic merit." Are we now witnessing the reverse, that is a tendency to utilitarianism?

Lange: I think that the issue of what has or has not "academic merit" is quite obsolete. We must ask ourselves what is needed? We are concerned with the objective of scientific effort. Galilei wished to know more about the world. I believe that we are getting closer to the real issue when we start from the acquisition of knowledge. What are the fields where we need it? Traditionally pure research, research in the field of natural sciences, was the "primary" field, while technology built on experiences. The notion of "seeking for application" arose from this separation. Nowadays nobody would dispute that natural science research represents an important, if not the most important, basis of technology and the development of production. On the other hand, technology itself is much more than applied natural sciences. It has spawned a science of its own. Incidentally, the technician is sometimes upset by the effect of natural laws. We only need to think of friction and wear and tear as well as the materials and energy losses involved therein.

Hofmann: From my standpoint, the following is happening: technology is now based more and more on natural science also. Entirely new kinds of technologies are generated by natural sciences, we need only think of nuclear technology microelectronics, laser technology and biotechnology. On the other hand, natural science needs efficient technologies and derives many useful impulses from that source. These are objective processes. The class war dictates the rate of the speed-up in scientific-technical advances. It is therefore impossible to have natural science and technology run parallel but apart; both need to interact in well thought out division of labor. That has nothing whatever in common with utilitarianism. Some countries have long and successfully achieved this objective. Unfortunately, German universities used not to admit technical disciplines, they did not fit their ideal of education. I also

oppose any unilateral demand for the Academy's research to be oriented more to technology. The presidium discussed how we can better respond to this objective and worldwide trend, sensibly organize the Academy from this aspect and allocate the technical sciences their proper place. The greatest volume of technology is established in industry; many technical disciplines are practiced at the universities. By now we have found out when it is necessary for us to deal with them. The Academy would not have been able to record its appreciable achievements in microelectronics if it had not devoted itself to engineering. Crystal breeding, disk production, structuring cannot be pursued any other way. This melding of natural science and engineering simply proceeds, in time, space and speculatively, in every respect.

SPECTRUM: Professor Guenther, you carried on contract research for NARVA at the Academy and are now responsible for basic research at that combine. What problems are you coming across?

Guenther: To begin with: Cooperation promotes this melding. However, results are always presented by industry, so that some academic researchers are tempted to emphasize their contribution. Petty squabbles, the so-called "search for the author," muddle the atmosphere. After all, it often happens that academic research merely helps to establish which approaches are likely to be successful or otherwise. Industry should really admit that it is often quite incapable of doing just that. From the very first we designed the contract so as to make sure that we should not "bleed to death" in contract research. The rule of thumb in our case: A third basic research, a third diagnosis and measuring technique, and a third cooperation in product development--and that worked very well for 10 years. Now I have changed sides and, as manager of basic research at NARVA, am responsible also for cooperation relations with universities and institutes of the Academy. I have noticed two points: Industry often tries to delegate a problem to the university or Academy and believes a solution could be found there without its input.

Even with the best will of the contract partner, he is left rudderless. The industry partner must make his own contribution. The second point is this: In its very natural eagerness to obtain the maximum benefit, industry tends to harass the contract partner and clamor for practice relevant and "useful" research only. Anyone letting himself be persuaded, renounces his own powers, because he will thus be unable to nurture his scholarly methods.

Lange: I would agree with that. It applies in most cases.

SPECTRUM: Is it possible to postulate that, at this time, revolutionary technologies can be generated only by basic research?

Guenther: I quite agree, provided you leave out the word "only." The targets of industry are supplied to 75 percent by market observation and market research. The way these tasks are carried out is largely up to basic research. Let me give you an example. The Tenth SED Congress calls for the rational handling of energy. This tendency is sure to persist. In my opinion, the replacement of the electric bulb is going to be the greatest challenge of the next 5 years, in other words we will have to find a source of light with a

function value very much like that of the electric bulb but with a far lower energy consumption. We have made the greatest progress with regard to the development of the compact fluorescent tube. Against the traditional wisdom, the attempt is being made so to compress a low pressure tube that it looks similar to an incandescent bulb. That, however, has undesirable effects on its light yield, and the tube has also become very costly. Consequently we have formulated alternative requirements for basic research, for gas kinetics in nonthermal plasmas and, naturally, want quick answers. Should a reaction kineticist tackle this question, he may need new mathematical instruments, because he is used to work with Bessel's functions. We, for our part, want to have divergent geometries. That scares him. This is an instance of our actually trying to inject a little pragmatism in natural science research.

Jobst: The situation is often much the same at the universities. The technical sciences and technology itself now generate so many profound problems for basic research, that it would be a sin to organize the rich potential of the Academy or the sections in a one-sided manner, oriented to immediate results only. The division of labor achieved is not yet satisfactory. I see the key issue as that of scientific research in the work on basic questions of the development of technology. It would certainly not be appropriate for the development of the disciplines and the progress of knowledge to independently handle all steps through the technical realization of a notion. It is unfortunately true to say that the solution of problems submitted directly by industry often provides quicker rewards. A basic researcher, even at a university, needs a tremendous amount of stamina because, though he "separates," the concrete technical "spectacular effect" of his basic studies is often achieved only by way of subsequent stages of research and development.

Hofmann: Of course it is also possible in the Academy to make results available very quickly for practical application, provided that the prerequisites are present. Effective research--in particular with a view to its application--implies the existence of advanced methodological capacity, theoretical preparedness, a reservoir of perceptions and experiences, making it possible to react quickly. Sometimes the solution is very close at hand. I include here the many thousands of consultations we carry out each year in the field of fractography, for example, which studies those substances that cause damage to machines, plant, equipment and devices. It is handled by our Institute for Solid Body Physics and Electron Microscopy which has been able with a relatively small staff and materials use to achieve substantial economic profits. Brought into play in addition to a great deal of knowledge were mainly efficient methods and experiences. Such very useful tricks can be provided only by those who draw on stocks of knowledge.

Lange: The Freiburg Research Institute for Nonferrous Metals that I helped to establish, did not come across any problem of transfer whenever it was possible to handle the work by calling on our own experiences and the design and workshop capacity built up in the institute. The small production department for special materials was intensively involved in this work. The prerequisite? That we were able to take the next step as soon as the knowledge was available or a decision required. This prompt response is very important indeed, because one cannot postpone everything to the next "plan round" without losing time and impetus.

SPECTRUM: Is it not imperative to inspire natural scientists with this capacity for cooperation on a much wider scale? How do we provide incentives to get greater movement?

Jobst: We have always been able to lastingly motivate natural scientists to the practical application of their findings if they perceived that the technical solution was not trivial, that they were allowed, for example, to remain physicists. Also, if the technical scientist got truly involved in their discovery. That is what it takes to let emerge what is usually called interdisciplinary cooperation.

Hofmann: In my opinion it needs no special motivation or stimulation or special measures to encourage such efforts. It is quite enough for the Academy to say: This is a field for the Academy and a field to be acknowledged. Let me cite the example of Academy member Karl-Heinz Schmeloovsky, an outstanding theoretician. However, he is also an inventor and pursues his notions, such as on fast digital signal processing, right up to their application in industry. The institute must provide the objectives, acceptance and social recognition by everyone. That is all.

Guenther: There are two classes of scholars. Some whose ears redden when it is a matter of Maxwell equations. They are unhappy if they cannot use them. The others are full of enthusiasm if they can switch something on or off at the end of their efforts. Both are important, and these basic classes should be preserved. Still, the most fruitful ones are those who have some of each.

Lange: My question would not concern the mechanisms we have but the people who are called upon to manage the processes. The most important factors are knowledge of the interrelations, abilities and the will to organize!

SPECTRUM: Let us stick to the facts: The Academy has promised to do more for the development of the technical sciences, in particular to improve the rate and the speed of innovation.

What are your concrete contributions?

Hofmann: Wherever new technologies arises from a natural science direction--as I mentioned earlier--, but also wherever an interaction with the original science is required. That is where we need to commit ourselves. Another criterion is the great multivalence in application such as persuasively demonstrated by the Central Institute for Cybernetics and Information Processes in the processing of images. Applications suggest themselves everywhere: In medicine, microelectronics, construction, even criminology. Images need to be prepared and processed everywhere. For the longest time we had little to do with machine construction. Now new relations are emerging as a result of automation, because robot technology, sensor technology, artificial intelligence, computer technology--all of these--enter as factors.

Lange: Of course we must deal with these questions by going back to the first principles and considering what in fact is essential. Still, it is equally important to ask what can in fact be done. The potentials of our national

economy are limited. That is not our reappraisal, it is an old experience: Research, development and production are subject to the ratio 1: 10: 100. While we can still afford the first one, we run into trouble with 1: 100. At the present time we are in fact biting off more than we can chew, and this results in poor efficiency and long delays until we arrive at implementation in production. Whatever we are discussing here, we must not permit a fetish to be made of new technology. After all, we need the old and current technologies to be able to afford as much new technology as possible. If we overemphasize innovations and strain our present possibilities, we burden the future. That is why I am so wholeheartedly for long-range conceptual effort. We must have come to terms with the forecast beforehand. That is a task for the Academy, too. It can do much in this respect, both by its research facilities and its classes.

SPECTRUM: We may also regard the proper distribution of forces as a distribution of proportions between spending on product development on the one hand and technology development on the other.

Guenther: Let us say it quite clearly. We tend to one-sidedly concentrate on product development and neglect process engineering. NARVA very quickly developed the sodium (vapor) high pressure lamp you see in all streets. That was a great contribution to rational energy application as specified in the state assignment. Until now, though, this has almost stopped at laboratory equipment. And yet it is apparent that the demand is very much greater than assumed. Who is to cope with that? No new manpower is available. Consequently, we badly need basic research on process engineering.

Hofmann: This applies quite generally. Compared with products, too little attention is devoted to equipment. The Japanese are very much concerned with the most important technologies and are then able very flexibly to turn out high quality products. After all, equipment lasts a lot longer than products.

One properly functioning piece of equipment can be used for the manufacture and further development of many products.

Guenther: Putting it in extreme terms: A product is worth absolutely nothing without the appropriate technology and process engineering.

Lange: The situation with regard to chemicals is quite different by the very nature of chemistry. The same applies to metallurgy, because the conversion of substances without technology would be an absurdity.

Jobst: It is true for everything to say that the "how" of production is now one of the best kept secrets.

Guenther: Yet I believe that the natural scientists cannot normally be a process technician also; in this respect the key is indeed with industry. For basic problems to arise therefrom for the Academy is both inevitable and desirable.

Jobst: Engineering increasingly means technology applied scientifically. Cooperation among the Academy, the universities and industry with regard to the

the engineering sciences, for example, must manifest itself by dealing with precisely those problems that may revolutionize the entire process. . . of traditional industries. This may affect saving processing stages in the metal processing industry. It will be imperative from the outset to produce more "customized" materials by--and I am talking here of the idea;--shaping them during smelting so that machine construction typical components may emerge. An important step in this direction is the establishment of an Institute for Mechanics in Karl-Marx-Stadt, which, in direct cooperation with the Technical College, devotes itself to the needs arising from technology. Another point that seems to me important is that of having technical scientists elected members of the Academy.

SPECTRUM: We have now learned of some problems. Is it necessary to develop a new strategy of cooperation with the industry combines to enable scientists more easily to deal and its thousands of small problems easier?

Hofmann: I would not go so far as to speak of a new strategy; I would rather call it further development. We must generalize our results and experiences, adapt them to the more challenging objectives. If it is a matter of striving for a greater renewal rate in production, we also must make good results and methods available more quickly. We can definitely not afford to transfer research results only when everything is complete or perfect. At the beginning of production, it is always necessary to be aware that problems of a scientific, technical, design or technological nature may arise. Another problem: Often we are not well enough informed about the developments going on in industry. Vice versa, we are still secretive also, incidentally.

Of course science must satisfy needs, on the other hand science also has the function to arouse needs. In collaboration with industry, the Academy must meet this dual responsibility. It can certainly do no harm for every scientist to acquire more managerial and operational knowledge--that would be a tremendous advance. We would like to make scientists more conscious of it. I consider it immensely important so that we may be able to cope with the more challenging assignments sure to be given us by the Eleventh SED Congress.

Academy member Ulrich Hofmann is first vice president of the Academy of Sciences and, since January last, chairman of the new Information, Cybernetics and Automation course.

Academy member Werner Lange is chairman of the Materials Science Class and member of the presidium of the Academy of Sciences.

Prof Dr Klaus Guenther is head of the basic research section at the research center for light engineering, NARVA Combine VE.

Prof Dr Eberhard Jobst is vice chancellor for social sciences at the Karl-Marx-Stadt Technical College.

Definition of terms used:

Technology: The total of the material means and processes created by man for the satisfaction of productive, informational,

consumer. . . needs. This is done by the application of natural laws but not reducible to them.

Engineering: Actual processes encompassing the means, processes, the flows of materials, energy and information--especially preparation and processing--and are therefore part of technology.

Technical sciences: The totality of disciplines dealing with technology in the widest meaning. Systems, technical structures and functions must be analyzed, appraised, intellectually anticipated, the relevant knowledge of natural and social sciences and experiences of technologies used and--as far as possible--phrased in terms of theory and generalized.

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HUNGARY

# PROTON INDUCED X-RAY EMISSION METHOD, ITS APPLICATION IN ANALYTICS

Budapest FINOMMECHANIKA, MIKROTECHNIKA in Hungarian No 6, Jun 84 pp 161-164

[Article by Dr Gyula Szabo, chief scientific worker at the Nuclear Research Institute of the Hungarian Academy of Sciences, Debrecen: "Proton Induced X-Ray Emission Method and Its Analytic Applications": material presented at a seminar on vacuum technology and analytics, Budapest, 20 Feb 84]

## [Excerpts] Summary

The proton induced X-ray emission method (PIXE) is a highly sensitive trace element analytic procedure which can be used on a broad scale. In the article we summarize the physical bases and characteristic features of the method, its applicability in various scientific areas and a few special procedures. We refer to the measurement procedure realized at ATOMKI [Nuclear Research Institute] and to the results achieved thus far.

## Practical Realization of the PIXE Method

For our measurements we are using the Van de Graaff accelerator of ATOMKI with a nominal voltage of 5 MV. A schematic diagram of the measurement chamber developed by us can be seen in Figure 3. The proton beam, generally 2 MeV, reaches the target object through an adjustable gap system, a dispersion foil, which serves to homogenize the beam, and a collimator system made up of exchangeable apertures. The entire chamber is insulated in the interest of being able to measure thin and thick samples with the same measurement system. The chamber also contains a carbon filament electron source fed by a small, ground independent power unit which serves to eliminate the charge build-up leading to a very significant increase in the background in the case of insulating samples. The effect of using the electron source is illustrated by the spectrum of a human liver biopsy sample, which can be seen in Figure 4.

In the interest of having our current measurement be reliable, that is, that electrons should not enter or leave the system, we connect a plus 200 V voltage to the outer housing of the collimator. A Faraday cage with a counter space is also built into the chamber; in the case of thin targets the current can be measured in this with suitable precision and so in these cases the correctness of the current measurement taking place in the entire chamber can be checked.

The target objects are placed at a 45 degree angle in relationship to the beam and the Si-Li detector serving to measure the X-ray spectrum is placed at a 90 degree angle in relationship to the beam. Absorbent foils can be placed in an exchangeable manner between the target object and the detector. Semi-automatic sample changing equipment equipped with a standard size slide store is connected to the chamber so that we can measure 36 samples in a series without breaking down the vacuum system.

The signals of the pre-amplifier of the detector go into an NZ-871 fast analog signal processing system developed in the institute; we then get the spectrum in the amplitude analyzer of an ND 50/50 data processing system. The PDP8/i computer of the ND 50/50 provides a certain degree of automation of the measurements, preliminary processing, assignment and storage of the spectrums. This latter computer is connected with the central PDP11/40 computer of the institute, on which the full evaluation of the spectrums and the determination of the necessary concentrations are performed.

The program system developed for a swift determination of the concentrations consists of two programs: the one called PIXEK calculates the data needed to determine the concentration; the second program, called REVAZOL, determines the parameters of peaks and background from interpolation done with the method of least squares and on the basis of the area of the peaks and the data provided by the PIXE program it also provides the concentration data in question.

#### Applications of the PIXE Method

Aerosols, solid particles in the air, can be filtered out simply with the aid of nuclear filters; indeed, they can be classified according to size with simple equipment, the so-called cascade impactors. Since the PIXE method can be used for the analysis of very small quantities of material we can obtain sufficient material by pumping through a few cubic meters of air and these samples can be measured without further preparations; thus the PIXE method is a very widespread and useful method for studying certain atmospheric processes or for environmental protection research connected with the pollution of the atmosphere or of the air in places of work. In the past year we regularly measured aerosol samples collected in the middle part of the country and an evaluation of the material for a 1 year period from meteorological points of view is now under way.

Research directed at clarifying the role of trace elements has come to the fore in biological research in the past 10 years. PIXE is a very advantageous research method also in this area because for the most part sample preparation means only drying and homogenization, or low temperature burning if enrichment is necessary. We recently studied several hundred human blood samples with the cooperation of physicians in order to determine what changes certain diseases and treatments cause in the trace element content of the constituent parts of blood. We have just started studies to determine the trace element content of vegetal parts.

The method can be used well to determine the trace element content of metals, for research on special technological processes and procedures, surface treat-

ments cause in the trace element content of the constituent parts of blood. We have just started studies to determine the trace element content of vegetal parts.

The method can be used well to determine the trace element content of metals, for research on special technological processes and procedures, surface treatments, diffusion and other surface phenomena, etc. And it can be used in geology, primarily to indicate the presence of trace elements. So far, we have not conducted such studies but our possibilities would permit this.

#### Special Procedures of the PIXE Method

The majority of PIXE studies are done in vacuum chambers similar to the one we described, but in recent years ever increasing use has been made of the so-called external beam method in which the bombarding beam is extracted from the accelerator through a thin metal foil. In many cases this procedure has very substantial advantages, in addition to increasing the current measurement and other monitoring problems. The size of the sample is less limited, it will be simple to measure liquids and aqueous solutions, reducing the work connected with preparing samples in general.

With systems made up of special precision quadrupole lenses it is possible to develop ion microsondes connected to accelerators. With these, in a manner similar to electron microsondes, one can produce finely focused charged particle beams with a diameter of a few microns and with intensities several times 0.1 nA. Because of the greater beam diameter the local resolution of these is worse than that of electron microsondes but their use facilitates a study of the dispersion of trace elements with a local resolution of several microns, by far more sensitively than with the aid of electron microsondes. In biology and geology the ion microsondes could provide results virtually unachievable in another way.

As we mentioned earlier, the X-ray-induced effect cross sections depend on the bombarding energy. This fact makes it possible to indicate concentration changes in surface layers of a maximum of 50-60 microns for solid samples. To do this one must measure the corresponding X-ray yields as a function of bombarding energy, and knowing the energy dependence of the effect cross section and taking into consideration the matrix effects one can determine the dependence of the concentrations on depth.

8984

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HUNGARY

SUPERCONDUCTIVE QUANTUM INTERFEROMETER (SQUID), ITS ANALYTICAL APPLICATIONS

Budapest FINOMMECHANIKA, MIKROTECHNIKA in Hungarian No 6, Jun 84 pp 165-167

[Article by Dr Sandor Meszaros and Dr Kalman Vad, scientific workers at the Nuclear Research Institute of the Hungarian Academy of Sciences, Debrecen: "Superconductive Quantum Interferometer (SQUID) and Its Analytical Applications"; a paper presented at the vacuum technology and analytics seminar organized by the Vacuum Physics and Thin Film Technology Coordination Committee of the MTESZ (Federation of Technical and Scientific Associations), Budapest, 20 Feb 84]

[Excerpt] Summary

In the article we describe the superconductive quantum interferometer (SQUID) developed by the Cryophysics Research Group of ATOMKI [Nuclear Research Institute] and the analytical applications of it, partly realized and partly under development. Considering that we can hardly speak of the domestic spread of SQUID instruments, we first describe its operating principle and then introduce two applications areas. As a picovoltmeter the SQUID is suitable for performing the most demanding resistance measurement tasks. As a magnetometer it is a very sensitive susceptometer, which can be used in NMR measurement technology as well.

8984

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HUNGARY

## VACUUM ENGINEERING DEVICES, EQUIPMENT

Budapest FINOMMECHANIKA, MIKROTECHNIKA in Hungarian No 6, Jun 84 pp 168-172

[Article by Istvan Berecz, chief scientific worker at the Nuclear Research Institute of the Hungarian Academy of Sciences, Debrecen: "Vacuum Engineering Devices and Equipment"; material presented at a vacuum technology and analytics seminar, Budapest, 20 Feb 84]

### [Excerpt] Summary

In the article we intend to give an overview description of the newest vacuum engineering devices of the Nuclear Research Institute of the Hungarian Academy of Sciences. In the introduction we provide a justification for the necessity of vacuum technology development. Then, broken down into three parts, under the headings of vacuum pumps, vacuum valves and measuring instruments, we describe certain vacuum engineering devices. In the last part we talk about the use of the devices described in large equipment and about a few vacuum systems interesting from the viewpoint of practical application.

### PHOTO CAPTIONS

1. p 168. Oil diffusion pump with pumping speed of 2,000 l/s.
2. p 168. Drawing of chilling trap which can be cooled with liquid N<sub>2</sub>.
3. p 168. Orbitron getter ion pump with pumping speed of 150 l/s.
4. p 169. Small capacity (2-5 l/s) magnetic getter ion pumps.
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HUNGARY

## ELECTRON SPECTROSCOPY, SURFACE TESTING AT ATOMKI

Budapest FINOMMECHANIKA, MIKROTECHNIKA in Hungarian No 9, Sep 84 pp 257-263

[Article by Dr Laszlo Kover, scientific worker at the Nuclear Research Institute of the Hungarian Academy of Sciences, Debrecen: "Electron Spectroscopy and Surface Testing at ATOMKI (Nuclear Research Institute"; a paper presented at the vacuum technology and analytics seminar organized by the Vacuum Physics and Thin Film Technology Coordination Committee of the Federation of Technical and Scientific Associations, Budapest, 20 Feb 84]

### [Excerpts] Summary

After an introductory review of surface testing methods, including electron spectroscopy methods, and their applications, we describe the electron spectrometers and electron spectroscopic devices developed at ATOMKI in recent years, with characteristic examples of their use. Finally, there is a discussion of our future developmental and applications plans and possibilities.

### Our Plans and Possibilities

Our developmental plans include, as an organic continuation of inner shell ionization research done with high energy ion-atom collision, the creation of conditions necessary for the electron spectroscopy of ion-solid body collisions. At the same time, we would like to go further in the area of analytic applications of electron spectroscopy--primarily from the side of method development.

In recent years outside demand for the electron spectroscopy devices of ATOMKI has increased also, but the material possibilities which can be turned to instrument development have been greatly reduced. At present we do not have either the internal development nor the manufacturing capacity for method and device development beyond the needs of our own basic research.

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HUNGARY

## GOALS, ACHIEVEMENTS OF MICROELECTRONICS PROGRAM

Budapest MERES ES AUTOMATIKA in Hungarian No 11, 1984 pp 426-429

[Article by Laszlo Schronk, manager of customer services, Microelectronics Enterprise, Budapest. Manuscript received 30 Aug 84 ]

[Text] Besides reviewing the objectives of the government's microelectronics program, the contribution describes the Microelectronics Enterprise, the production of MOS and bipolar integrated-circuit chips, the specific R&D results to date, and the plans for future R&D activity.

Today the installed electronic components determine the modernness and competitiveness of electronic equipment.

Consequently, industry is demanding ever-newer, more modern and more complicated microelectronic components.

The Hungarian electronics industry has good traditions. Earlier, in the age of vacuum tubes, it was still well able to keep up with the European level. But when transistors became widespread, it lagged behind the European level, and has been unable to keep pace with the rapid rate of development since then.

The comprehensive development of the production of microelectronic components has become essential to enable the Hungarian electronics enterprises to maintain their competitiveness, and to improve it in some areas.

The government program for the production of microelectronic components, which we will outline below, makes possible the production of competitive products in spite of our lag, and also permits the industry's further growth.

### Objectives of Microelectronics Program

At its 23 December 1981 session, the Council of Ministers adopted a resolution on a "central development program for electronic components and subassemblies."

This long-awaited important decision earmarked nearly 4.5 billion forints for the program's realization, identified the most important tasks necessary for



the realization of R&D and production, and specified the necessary organizational changes.

These organizational changes were necessary because previously the researchers, development personnel, and manufacturers had been working under the supervision of several different central agencies, realizing the concepts and interests of these agencies.

The Microelectronics Enterprise (Mikroelektronikai Vallalat) was established as of 1 January 1982. It comprises the following: its predecessor, the Telecommunication Industry Research Institute (HIKI); the Budapest semiconductor development and experimental production subdivisions of the United Incandescent Lamp and Electrical Company (EIVRT), now the Tungstam Company; and the Gyongyos Semiconductor and Machine Factory (Gyongyosi Felvezeto es Gepgyar) that has been split off from EIVRT effective 1 January 1983.

The Council of Ministers is treating the microelectronics program as a preferential program and has appointed a government commissioner to manage it. He is Dr Mihaly Sandory, former deputy director general of the Central Physics Research Institute (KFKI) of the Hungarian Academy of Sciences (MTA). As of 1984, he is also director general of the new enterprise.

The basic task of the established Microelectronics Enterprise is to supply the Hungarian electronics industry (the telecommunication equipment, medical electronics, instrument, automation, and computer industries) with modern micro-electronic components and subassemblies.

The production of IC chips is being realized at the enterprise in accordance with the above principles.

In the first stage, experimental production was begun in April 1984, on an MOS production line purchased from the Soviet Union. The new project has been built at the enterprise's main plant, in Ujpest. Its capacity, operating in two shifts, is 60,000 NMOS chips a year, for three supply voltages. The chips are 3 inches in diameter. With the introduction of technology yet to be bought and of our own technology, this production line will be able to produce as of 1985 NMOS and CMOS chips with one supply voltage, for memories, custom circuits, and off-the-shelf circuits.

In the second stage, at the end of 1984, the production of bipolar chips will be introduced, under the same conditions and with the same capacity as above.

This domestic production of IC chips will enable us to develop and start making so-called full-custom and semicustom IC's that have lately been spreading, for greater competitiveness and economy.

The establishment of (MOS and bipolar) chip production in Hungary under the government's microelectronics program provides an opportunity to expand our collaboration and cooperation with the other socialist countries.

While improving the supply of domestic demand, the Microelectronics Enterprise is striving for better utilization of our production capacities (maskmaking,



## Results of Microelectronics Program

The installation and trial operation of the MOS chip line were completed in 1983.

In 1984, experimental production was begun on this line of the 2107BPC n-channel dynamic MOS RAM chip organized as 4K x 1 bit, on the basis of a Soviet license.

Parallel with this experimental production, we are adapting to this production line the technology we purchased from the GDR for the 2102APC n-channel static MOS RAM chip with one supply voltage, organized as 1K x 1 bit.

Through our own R&D efforts, the following full-custom and semicustom circuits have been developed:

### Using n-channel MOS LSI technology:

The U 400 gate array (semicustom). It contains 400 cells corresponding to four-input NOR gates, and 37 I/O cells. The cells are connected to the leads in accordance with the customer's requirements.

The GA 800 gate array. The circuit's internal structure comprises: 33 [sic] twin cells arranged in a 5 x 7 matrix, or a total of 70 array cells; a master-slave accumulator; six two-input NOR gates; and an inverter.

### Circuits developed in bipolar technology:

The SARY-100 LSTTL gate array. Containing 96 internal logic cells (NAND gates) and 12 I/O cells, it is advantageous for high-speed digital applications. At  $U_{cc} = 5$  V, the speed of the internal logic cells is 8 nsec, and that of the I/O cell is 10 nsec.

The LINA-1 linear array. Very versatile for implementing linear circuit functions. Has 36 n-p-n transistors ( $I_{max} = 20$  mA,  $f_T = 300$  Mhz), 12 double-collector p-n-p transistors ( $I_{max} = 1$  mA,  $f_T = 1$  Mhz), and 120 resistors ranging from 300 ohms to 300 kohms.

There have been important measures for the training of experts. Budapest Technical University is offering majors in microelectronics and microelectronic technology. And the necessary conditions for the postgraduate training of practicing engineers have been ensured at the Institute for the Further Training of Engineers.

There is slippage in the realization of bipolar technology and its production line. In spite of the financial and delivery difficulties, this investment too will be ready by the end of the year, and trial operation will be able to begin in 1985.

## Review of R&D Results

In the following we present information about the topics specified in the Microelectronics Enterprise's R&D plan, the developed types, and our conceptions for the future.

### Integrated Circuits

Much of the production at the IC fabricating and testing plant in Gyongyos at present is with imported chips. The purpose of the (MOS and bipolar) chip production established under the microelectronics program is substitution of a part of the chip import, and broadening the assortment with IC's that we ourselves have developed.

### Bipolar Integrated Circuits

#### -- The 74... standard TTL family:

We are not planning any domestic production on the basis of our product development concept. To load the capacity of the IC fabricating and testing plant in Gyongyos, we will fabricate each year about 40 of the more complicated types in the higher price range, striving to substitute chips from socialist countries for the chips imported from capitalist countries.

#### -- The 74LS... TTL family:

Using our own R&D results and acquired licenses, we intend to fabricate as of 1985 some of the IC's in this family, using our own chips made on the bipolar chip production line. We will continue to fabricate the rest of the IC's in this family using imported chips.

#### -- Interface circuits:

On the basis of our own R&D results, we will begin to make chips for some of the IC's. Temporarily we will continue to fabricate the remaining IC's using chips imported from capitalist countries.

#### -- Microprocessor, ancillary-circuit and bipolar memories:

To supply the domestic demand, we are fabricating the types included in the Microelectronics Enterprise's assortment, using chips imported from capitalist countries, until we substitute chips that we ourselves will have developed or chips imported from other socialist countries.

#### -- Linear circuits:

We are planning to start the production of chips as of 1985, on the basis of our own R&D results. We are in the process of introducing DIL-8 minidip encapsulation, which will enable us to produce additional types.

#### -- Consumer electronics circuits:

In accordance with the needs of the domestic radio and TV manufacturers (Orion, Videoton, BRG [Budapest Radio Engineering Factory] and EAG [Electro-acoustical Factory]), we will develop our assortment, using our own R&D results and by acquiring licenses.

-- Voltage regulators:

We intend to start the series production of a precision voltage regulator and of constant voltage regulators, using chips which we ourselves will develop and produce.

### MOS Integrated Circuits

-- The CMOS 4000B family:

On the basis of licensing, we will begin in 1985 to fabricate some of the IC's in this family, on the MOS chip line. To achieve economies of scale, we are willing to exchange our products for finished products or chips (slices), within the framework of cooperation with socialist partners.

-- MOS memory chips:

In addition to the memory chips mentioned earlier, in our MOS chip fabrication we are planning the gradual introduction of several more memory chips. For example: 2114 RAM, 2141 RAM, 4116 RAM, 2708 EPROM and 2716 EPROM.

### Discrete Semiconductor Devices

-- Subminiature semiconductors:

We have begun the production of SOT-23 encapsulated transistors and diodes for hybrid circuits. These are being used in part in our fabrication of hybrid IC's, and in part by Remix. The types currently in production are:

BCW 29(R) ... BCW 33(R)  
BCW 69(R) ... BCW 72(R)  
BCW 60(R) ... BCW 61(R)  
BCW 70(R) ... BCW 71(R)

-- TO-3P plastic-encapsulated transistors:

With the introduction of TO-3P encapsulation, we are developing the still lacking high-power types of power transistors primarily to supply domestic demand. This form of encapsulation also permits the implementation of TV sweep transistors and regulators as IC's. The types currently under development are the BD 245, BD 246, BD 247, BD 248, BD 249 and BD 250 complementary transistors, and the BU 426 sweep transistor.

-- X and T plastic encapsulated high-frequency transistors:

At present we are using imported chips to fabricate the Si planar and MOSFET transistors for the tuners of TV sets. Because the domestic TV set manufacturers and our cooperating partners are using these transistor types in large volumes, we have begun the domestic development of the chips for them.

-- Power rectifier diodes:

To our present line of 1-amp network and fast-recovery diodes we will add 3-amp, high-voltage and bridge-rectifier types, by acquiring licenses and partially on the basis of our own R&D.

### Hybrid Integrated Circuits

The catalog of the Microelectronics Enterprise contains a wide selection of hybrid circuits. We would like to call to your attention the following types that have been developed recently:

The HAD 13 12-bit analog-to-digital converter. Its short conversion time (50 microseconds) and good temperature tracking (30 ppm °C) make it suitable for a wide range of applications.

The HWA 21 wide-band amplifier. Suitable for TV master antenna systems in the 40 to 860 MHz frequency band, with 24 dB gain.

The HBP 15 data-channel filter. An active resistor-capacitor band-pass filter of the 14th order.

#### Acoustical Surface-Wave Filters

The band-pass filters now manufactured or in the stage of development can be used in the intermediate-frequency amplifier stage of black-and-white and color TV sets. They meet the standards of both the IRTD and IRCC.

The HSW 03K TV i-f filter, for both international standards.

#### Liquid Crystal Displays

The catalog of the Microelectronics Enterprise offers a wide selection of liquid crystal displays varying in size and the number of characters. The enterprise will undertake to develop also displays with icons, in accordance with the customer's requirements.

#### Sensors

Using semiconductor microelectronic technologies, the Microelectronics Enterprise has developed devices able to sense various physical quantities.

Gas sensors are thick-film resistive elements whose conductivity changes significantly under the influence of various gases.

Humidity sensors are capacitors made of a porous dielectric. Through changes in their capacitance, they indicate relative humidity values in the 20 to 100 percent range.

Pressure sensor are made of piezoresistive resistors in a Wheatstone-bridge arrangement. They are very sensitive, but at the same time their nonlinearity and temperature dependence are negligible.

Heat sensors are resistors made of silicon single crystals, and their temperature dependence is exclusively a function of their concentration of doping material. The heat sensors are now in the stage of development.

Optoelectronic sensors, of which the following have been developed and assigned to production:

- The BPV 110 photodiode,
- The BPV 210 photovoltaic cell, and
- The BPA 200 avalanche photodiode.

In conclusion it may be established that the founding of the Microelectronics Enterprise under the government's microelectronics program, the realization of MOS and bipolar chip production, the R&D objectives and the results achieved to date permit the development of CEMA cooperation that will help to overcome the consequences of the discrimination we are experiencing in the world market, and to ensure the supply of the microelectronic components and subassemblies that the socialist countries' electronics industries need for their production.

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CSO: 2502/40

HUNGARY

# COMMISSIONER FOR MICROELECTRONICS PROGRAM QUIZZED ON PROGRESS

Budapest MERES ES AUTOMATIKA in Hungarian No 11, 1984 pp 397-398

[Interview with Mihaly Sandory, government commissioner for microelectronics and director general of the Microelectronics Enterprise: "My Personal Opinion...About The Microelectronics Program"]

[Text] Readers of MERES ES AUTOMATIKA may be acquainted with the more important goals of the Central Electronics Development Program from articles which appeared in this column and in special issues in 1982 and 1983.

As in earlier years the leader of the program answers the questions of the Editorial Committee.

[Question] Disregarding minor recoils the electronics industry of the world is developing very dynamically. At the same time the development of the domestic electronics industry is slower. Development is especially slow within our microelectronics industry. At least this was the situation a few years ago. Has the situation in this area changed, or is it still too early to ask this question?

[Answer] The goal in connection with the development of the microelectronics industry was not quantitative, rather it was qualitative. I consider it very great progress that we are able to produce good numbers of IC's at the upper limit of MSI or, if you please, at the lower limit of LSI, and that to enter the upper region of LSI we need "only" study and need not invest. In addition, the annual 12-15 percent quantitative factor of development is important, but still of secondary significance.

[Question] In your answers given to questions posed in earlier years you said that the present investments must create the foundations for a more significant development of microelectronics in the future. Have these foundations been created and if so to what degree?

[Answer] Our investments have created the planned foundations. We have created an infrastructure which can reliably provide technologies with a resolution of 3 microns. Our machine park can be upgraded with some supplementation. So we have created the foundations for further development in the Seventh 5-Year Plan.



[Question] How do you judge our efficiency and to what degree does the present regulatory system limit domestic activity in this area?

[Answer] At present our regulatory system is far from determining or limiting the efficiency of our microelectronics industry. Of course, the Microelectronics Enterprise or any other enterprise could be put into a very difficult situation with "appropriate" regulation. But it is the aspiration of the financial organs to ensure the optimal possible operation of microelectronics parts manufacture within the framework of our regulatory system. For us the tools for increasing efficiency are primarily study, work organization, improving the guidance system within the enterprise, better assets allocation, etc. We do have problems, concerning regulations, in the area of manpower supply--the present labor affairs and wage payment system do not promote to utilize in multiple shifts of our very valuable production equipment either in Budapest or in the provinces.

[Question] Under capitalist relationships capital is extraordinarily sensitive and always moves toward the most prospering branch of industry. Do you consider capital movement among the various branches of industry in Hungary to be satisfactory?

[Answer] In our economy there is neither a capital market nor a manpower market. We have not created, for capital or for manpower, a force field which would facilitate movement toward the prospering branches of industry. It would be a suitable force field if the owners of capital (and not the state; the state has guarantees, it only lacks the information necessary for optimal investment) could count on being able to freely dispose of the extra enterprise income created by the investment of capital. Practice shows rather the opposite of this; the extra income will almost certainly be withdrawn so there is nothing to make capital move. If there were a force field on the manpower front then a worker could win a significant income difference by moving. Today there are only fractional differences between the incomes of workers of "prospering" enterprises and those going bankrupt. I would like to emphasize that I say the above not to characterize the situation but simply to describe it. I am not an expert in this area; it is possible that everything must be this way in the present phase of our economic development.

[Question] Have you surveyed the possibility, so fashionable today, of issuing bonds in this area?

[Answer] The possibility has been surveyed, and I do not consider it realistic in practice. The area is an abstract one for the population, far from them and unknown. So we could count on only a very narrow stratum. From the other side the conditions for issuing bonds are restricted to the extent that some sort of "securities market" cannot be realized here.

[Question] Nothing indicates better the dynamic development of the electronics branch than the fact that a very large number of new firms are being formed, in contrast to, for example, the auto industry where

a few large firms are operating. For years only the appearance of a few Japanese factories has represented new firms in this branch of industry. This also means that individuals with a more enterprising spirit, desiring something new, are increasingly seeking to make a breakthrough in the electronics branch. How could we mobilize the ambitions of such dynamic individuals under domestic circumstances?

[Answer] I would formulate the answer in three ways, noting that all three mean the same thing, the formulation depends on whom we intend the answer for. The three answers are: No way! With great difficulty! True talent breaks down all barriers.

[Question] The microelectronics branch is still not attractive enough among the university students. In the area of domestic placement the students do not consider their professional and individual economic opportunities to be satisfactory; indeed, they feel them to be weaker in comparison to the domestic average. But such an innovative branch of industry must be made attractive to the most dynamic individuals. Is the above statement true and if so what ideas do you have for changing the present state of affairs?

[Answer] Let me begin at the beginning. A technical career is not attractive to young people, there is actually a contraselection. It has been said in many places that this is not good, and I myself agree with this. But I have not yet seen an analysis which would frankly study why this situation developed. One reason might be something like this--I am being subjective, but I consider the problem very essential and it is very close to me--there are two strata, among others, in our economy. One stratum works and the other watches to see if the working stratum commits some sort of irregularity. So obviously it is understandable that the youth are attracted to the latter.

Even within the technical area microelectronics does not belong among the truly popular. The placement possibilities here are very limited, there is essentially no possibility of job choice after graduation.

[Question] Do economic work associations function within the MEV [Microelectronics Enterprise]? Do they have sufficient scope to provide dynamic development?

[Answer] They do, and do so successfully. We should drink the coffee substitute with enjoyment--of course, only as long as we have no way of getting real coffee. It is probable that the GMK's [economic work associations] will not provide the dynamic for the development of the microelectronics industry even for us.

[Question] Do you intend to expand the activity of the GMK's within the MEV?

[Answer] The profile of the MEV is extraordinarily varied. I think that such an enterprise should be guided in such a way that, as far as possible, every part of the profile which is independently viable should

also prosper independently, with independent undertakings carried out within the given framework. The MEV in every possible way supports this, including material and technical support.

[Question] The spread of equipment-oriented circuits has another very significant role in advancing technology, beyond the utility of the concrete circuits. This is the spread of automated designing methods. As I understand it a configuration is developing as part of the present program which may be transferred to other users and access to a common database will be part of this system. Can we hear something about the proposed system, its software and price and the time when it will be available?

[Answer] The system about to be completed will make it possible for about 50 engineers to work simultaneously at various levels of automated design. The levels are testing, simulation, automatic layout design, interactive jobs, etc. It would not be proper to go into the details here, we should find some other form for describing the system.

[Question] Western firms have developed a number of designing centers, often far from the parent factory--for example, connected with the parent factory via satellite. As I understand it these firms might be inclined to accept Hungarians also. Have Hungarian experts visited such sites, do we have concrete empirical knowledge about the services these firms make available to users?

[Answer] I am not aware of it. But a very extensive literature describes the services of these firms and this is accessible.

[Question] We have reached the most jolting group of questions, domestic circuit manufacture and the advertising and propaganda activity connected with it.

Domestic technical public opinion is extraordinarily distrustful of domestic parts manufacture, its technical level. And let us confess that this is not without foundation, despite the fact that many adopt and support the goals of the EKFP [Central Electronics Development Program]. Is the above statement true?

[Answer] As a user, I also was distrustful. I think that the activity of the MEV thus far has resolved somewhat the technical part of the distrust. I cannot yet allay the "commercial" part of the distrust with facts. If someone uses MEV parts he is at the mercy of the MEV. In order to allay the distrust there must be an effective solution to the problem of second sourcing; we are talking with three partners in this matter, but there are no publishable results yet.

[Question] I am convinced--and the facts support this--that domestically there has not been sufficient recognition of the importance of training, educating and informing technicians in order to spread the new in connection with a single theme--except for the equipment-oriented circuits.

This is simply a statement of fact, and I would appreciate your listing here the measures taken in this area thus far. Such a listing might give an impressive answer to the doubters.

[Answer] The question of education has been on the agenda since 1982. In my judgment we have gotten beyond a very effective training of teachers and as of September this year we had created conditions for further professional training of several thousand engineers in a short time (1-2 years) in a study course at the Continuation Training Institute for Engineers.

[Question] Is there a method in the bag with which we might increase the number, professional knowledge and favorable experiences of the users of circuits?

[Answer] There is not.

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HUNGARY

## USES OF, EXPERIENCES IN PRODUCTION OF CUSTOM DESIGNED IC'S

Budapest MERES ES AUTOMATIKA in Hungarian No 11, 1984 pp 399-405

[Article by Ferenc Heksch, Microelectronics Enterprise: "Questions of Use of and Experiences Thus Far With Custom Designed Integrated Circuits"; received for publication 3 Aug 84]

### [Excerpts] Summary

The article provides an analysis of the complex theme of custom designed integrated circuits. It reviews the necessary information and the factors influencing the user-manufacturer interface and describes the potential of the custom designed circuits of the MEV [Microelectronics Enterprise], the experiences thus far and the peculiarities determining the forms of behavior.

The first domestic semiconductor wafer technology manufacturing line is in operation and has become the industrial base for microelectronics here. Within the microelectronics program, and considering the conditions of the electronics branch of industry, special attention is being given to custom designed integrated circuits (BOAK's) from the point of view of user and manufacturer alike.

### Development of the MEV BOAK\* Assortment and Chief Characteristics of Types

In order to review the MEV part of the domestic experiences let us first briefly summarize the technical foundations.

### BOAK Technologies

To continue satisfying the need for custom designed circuits better than before has been at the center of the developmental ideas of the MEV since its creation. We are using all the silicon based integrated circuit technologies in our possession as a result of a license purchase as well as our own development to produce BOAK's. Table 2 summarizes the MOS technologies and Table 3 summarizes the Bipolar ones.

\*BOAK is a registered trade mark of the Microelectronics Enterprise. [Note: The literal translation of the Hungarian words for which BOAK is an acronym is "equipment-oriented integrated circuit"]

Table 2. MEV MOS Technologies

Name	Transistor channel type	Characteristic channel length (microns)	Material of control electrode	Existence of depletion load	Supply voltage (V)
PFG	P	7.5	Al	+	+5;-2...12
PSG	P	7.5	Si	-	+5;-12...25
NSG 1	n	5	Si	+	+5;
NSG 2	n	5	Si	-	+5; +12
CFG	complementary	7	Al		0;+5...18
CSG	complementary	5	Si		0;+3...18

Table 3. MEV Bipolar Technologies

Name	Smallest geometric element (micron)	Isoplanar structure	Suitable for High voltage
LSTTL	5	+	-
Interface	5	-	-
Industrial linear	5	-	+
Consumer	5	-	+

Table 4 illustrates the use of the several technologies for approaching various BOAK's, as a result of their characteristics.

Table 4. Use of the Technologies

Technology used	Manufacture of catalog IC's	Custom Designed Integrated Circuits		
		Gate array	Cellular design	Other design
PFG	-	-	+	+
PSG	-	-	-	+
NSG1	+	+	+	+
NSG2	+	+	+	+
CFG	+	+	+	+
CSG	+	+	+	+
LSTTL	+	+	+	+
Interface	+	-	-	+
Industrial linear	+	+	-	+
Consumer	+	-	-	+

#### Families of BOAK Types

The ability of the MEV to offer BOAK's is developing continuously and gradually as a function of the maturity of the several technologies and the designing demand of the type families.

In accordance with this there are types and technologies in which we were ready to make deliveries in 1983; for other families we are not producing the first samples or delivering a larger series before 1984 or 1985.

The designation of the type family applies only to OEM BOAK's. Table 5 contains a few data and design characteristics of the present MEV offering of these.

Table 5. MEV OEM BOAK Families

Family Type	BOAK Method	Technology	Complexity (maximum gates)*	Maximum clock frequency (MHz)	Modeling kit	User layout plan
U400	array	NSG2	400	2	--	possible
GA800	array	NSG1	800	4	--	possible
CA1000	array	NSG2	1,000	3	--	--
TMC100	cell	PFG	500	0.1	--	--
TMC200	cell	NSG1	1,000	5	--	--
SARY-100	array	LSTTL	100	20	yes	possible
LINA-1	array	industrial linear	50 tr, 120R	--	yes	possible

\*Equivalent to input NOR/NAND gates

#### Trends for Further Development

It follows directly from the character of domestic needs that one task for the MEV is development of a CMOS OEM offering. We began development of the CMOS gate array types in the 400-1,500 gate range and expect to be able to make deliveries by the end of 1985.

There will be a number of directions to the further development of the present type families. The gate array types will be developed in the direction of greater complexity and easier use.

For example, in accordance with domestic needs, there will be a UA420 version of the UA400, with smaller current outputs but with a single 5 V supply voltage and a UA240 version with 240 gates but with "power instrument" outputs.

The SARY and LINA types will be able to do more, partly in regard to complexity and partly in regard to the supply voltage range.

With increasing complexity the efficiency of manual designing methods decreases greatly, so we intend to offer our users increased and improving quality computer and applications technology service.

The following chapter will deal in more detail with the service characteristics.

## Developmental Experiences Thus Far

The BOAK area is strictly a service area. In this respect it differs fundamentally from the manufacture of catalog IC's. In every other respect it is inseparable from it. Only a stable, standard technology for the manufacture of catalog IC's can be a base for the economicalness of the production of BOAK's at a suitable technical level, including reliability. So it is proper to ask why BOAK propaganda preceded, in our case, the placing into operation of the manufacturing line. It is not only a domestic but also an international experience that the use of BOAK's requires a change in attitude--primarily from users.

From the technical side the change in attitude must be supported by new methods and tools and better documentation for user designing work. From the economic side there is a need for precise market research, an adequate knowledge of values and resources. Considering all this the BOAK propaganda thus far can be regarded as too little but it certainly cannot be regarded as too early.

We will consider the developmental experiences thus far from the viewpoint of the need and appearance of BOAK's user behavior and the behavior of the MEV and the development of its capabilities, concentrating on the most characteristic problems.

### BOAK Needs and their Appearance

In the past 3 years we have registered more than 100 needs at our enterprise, which can be grouped into the following types:

- a. Follow-up development of catalog types. In a few cases users have tried to acquire the part needed in this (BOAK) form. In-so-far as the MEV found it suitable from the technological, technical and economic side it included the type in the assortment of catalog IC's.
- b. Integration of an equipment card (or part thereof) already being manufactured. Whether we are talking about realization of the original function or of a function to be developed further, this area belongs to the OEM technique, which is a domestic peculiarity to the extent that it is interdependent with series size. A significant number of the integration requirements are of this type.
- c. Development and integration of a new function. Use of BOAK's is of greatest utility here and it is not by chance that this is the largest needs group. (Those tasks of the preceding point belong here also if a new systems technology achievement results.)

The tasks have appeared through very many channels:

- the expert board of the Microelectronics Government Commissioner;
- consultations of MEV leaders;



- the MEV Commercial Main Department;
- the MEV Designing Department;
- the MEV Bipolar Design Department; and
- faculties and institutes of the Budapest Technical University

#### Forms of User Behavior

The more than 100 needs defined thus far at some level and the consultations of the BOAK team of the MEV with experts of domestic industry have resulted in very useful experiences for users and manufacturers alike, going beyond the inestimable value represented by the establishment of contact. The forms of user behavior might be reviewed in connection with the factors most influencing the relationship to BOAK's.

##### a. Technical Level of User Enterprise (Section)

From the viewpoint of BOAK's the domestic spectrum raises problems similar to those which can be found at Western European OEM conferences. In addition, all six versions of the user-manufacturer interface mentioned earlier have occurred in domestic practice.

Especially in the beginning the needs included a few which could not be integrated because of their low technical level, among other things. We are thinking of circuits "developed with a soldering iron" where the connections could be made operable in the construction phase with a number of after-the-fact forced solutions (filter condensers on the signal leads, use of differentiating and integrating RC members, etc.).

It is reassuring that in the course of the further training of the users in microelectronics a number of experts studied and fell in love with the use of modern simulation programs, as a result of which the time to work out initial specifications is decreasing.

##### b. Price Level and Profitability of User Enterprise Products

A few domestic enterprises are in the peculiar situation that they can sell their products at a price above the world market and thus the economic constraint to use BOAK's appears only in a subdued way.

In other cases--and fortunately a change in attitude can be felt here already--the unit price of a BOAK which can do more than the original function is limited only to the total price of the catalog parts replaced. It is our feeling that this is because the material assets that would make the manufacturing technology more flexible are lacking for the modernization of the product through use of BOAK's.

In general, in the case of the manufacture of a small number of devices the use of catalog circuits is economical.

### c. Price Questions

In the course of a popularization from various sources voiced at many forums, erroneous price information has been voiced in regard to both development and unit price. Even independent of this some purchasers are trying to attain a more favorable position in the market competition exclusively with the lowest possible prices for BOAK's. This attempt is ever more pronounced with the increasingly dominant role of parts in the equipment price.

### d. Propagator at User End

To the extent that the user has designers who regard use of BOAK's as a labor of love, in addition to the technical-economic arguments, the effect of all the problems outlined thus far decreases many times over. An expert on the spot at the user end, well acquainted with the unique conditions, can dispel the superfluous anxieties and adjust the excessive expectations. It has been found that the existence of such a propagator is crucial from the viewpoint of the creation, speed and success of a BOAK theme.

### e. Delivery Security

It need not be explained how much less risk is involved in processing a flexibly transformable gate array wafer and in storing wafers or finished BOAK's as compared to obtaining and storing several hundred different sorts of parts.

User behavior certainly keeps delivery security in mind and this coincides with the goals of the domestic microelectronics program.

## Behavior of MEV and Development of its Capabilities

### a. Supply Character

The course of business for BOAK's differs fundamentally from any other integrated circuit activity. Since it is strictly a supply service it requires relatively great designing work compared to the number of IC's produced. The reverse of this point is the requirement in the case of catalog circuits to produce series of at least a million with a limited assortment. It is the international experience that any enterprise the BOAK activity of which is not a separate branch of operations will suffer constantly from the inadequacy of the design resources, independent of the level of computerized design. This appears in the sometimes unrealistic business condition whereby they set the minimal number of units which can be ordered too high (tens of thousands).

The domestic situation, as we have noted already, is favorable in this regard.

### b. Applications Assistance

The OEM case also differs compared to catalog circuits and ad hoc design circuits. In the case of a BOAK with a unique design this is limited essentially to a harmonization of the specifications. In the case of catalog circuits it means primarily publication of applications examples and recommendations. In

contrast to these cases, the assistance turns inward when designing OEM, thus array type, or cell circuits; that is, it applies to how we should integrate a given circuit on a chip at a minimal price in the case of a given, already arranged assortment of elements. This requires an applications technique engineer dedicated to offering assistance, which involves full-time and very specialized work.

These members of the BOAK team of the MEV have the required systems technology and circuit knowledge to carry out these tasks, but because of their small number they are forced to include the active participation of the users in designing. From the MEV side there are not only personnel reasons for the participation of the users. They have prepared and are preparing designing aids and video programs teaching their use which will orient outside designers in making use of the services of the MEV.

Users have been able to link into the design of BOAK's for 6 months through the Central Design System of our enterprise on Foti Street and will be able to do so at the end of the year at the Customer Service Design Station on Vorosmarty Street.

#### c. Second Sourcing and Inventory Questions

In international practice second sourcing means the same technology, the transferability of designs and the same designing rules. This has significance primarily for very large series types, either catalog or individually designed BOAK types. It can also be observed that multiple sources have developed in the area of gate array designing systems (cell library, master wafer wiring and testing programs).

There is no need for second sourcing a small series gate array metallization (1,000 units).

Feeling the need of users for source security the MEV is planning to develop second sourcing for the types described above with the microelectronic factories of socialist countries. The partners to be established have received favorably our request to build up direct bilateral contacts.

The inventory problem leads to extra costs in the case of gate array types used in small unit numbers each year, but because of the small volume this is not significant. For example, the annual unit number need for a U400 type is 150-200 units and the total unit number is 1,000 units. For manufacturing organization and technical reasons the total quantity must be manufactured and shipped in one batch.

Delivery of cell or individually designed BOAK's in unit numbers of 10,000 can be solved with annual scheduling.

The MEV is developing its BOAK capability in regard to both technology and applications techniques.

Applications technique assistance means the following:

- a feasibility study;
- providing use of computerized simulation programs;
- designing aids;
- constant consultation assistance in circuit, design, methodological, specifications and price questions.

With completion of our Central Design System on Foti Street and with introduction of the Customer Service Design Station on Vorosmarty Street the capacity and level of the BOAK service of the MEV will increase significantly.

#### Conclusions

The BOAK theme is in itself the best example proving the uniform nature of electronics. If the domestic electronics industry is to turn the advantages deriving from BOAK's into economic achievements efficiently then there is a need for a change of attitude on the user side--greater discipline, more modern designing methods and a precise self-knowledge--and on the manufacturing side there is a need for a sure mastering of the technology, professional use of designing methods and a high level of microelectronic services.

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HUNGARY

## MODERN EQUIPMENT FOR MANUFACTURE OF IC'S IN HUNGARY

Budapest MERES ES AUTOMATIKA in Hungarian No 11, 1984 pp 412-417

[Article by Dr Janos Erdelyi, Microelectronics Enterprise: "Modern Machines for Domestic Integrated Circuit Manufacture"; received for publication 10 Aug 84]

### [Excerpts] Summary

A significant microelectronics investment is being realized at this time in the interest of improving the supply of parts to the domestic electronics industry. Machine lines to manufacture MOS IC elements (chips) have been put into operation and mass manufacture of chips has begun after successful test operation. Installation of machines to manufacture bipolar IC chips began this year as well and according to the plans mass manufacture on these machine lines will begin in 1985. The modernness of the machines installed can be considered of interest; this determines fundamentally (but not exclusively) the economicalness of manufacture and the modernness of the IC's which can be manufactured. The article discusses these questions.

### Microelectronics Enterprise Machines Which Determine Technological Modernness

Hungarian experts selected the wafer technology machines of the MEV [Microelectronics Enterprise] in agreement with the Soviet experts transferring the MOS IC license and as a result of talks conducted with the capitalist machine manufacturers or machine vendors.

The machines which determine technological modernness--those of Soviet and capitalist origin alike--had been tested in mass manufacture but at the same time are relatively new, developed not more than 5 years ago. The chief technical parameters of these machines are as follows:

### Machines for Mask Preparation

a. Optical Pattern Generators: of Soviet and GDR manufacture. Suitable for 10 x scale first photograph preparation. The circuit elements are produced with total photography of variable scale element quadrangles. One step, photographing each quadrangle, takes about 1 second. During this time the table holding the photo sheet and moved by linear motors is put into a new X-Y position with a precision of 0.25 microns, the new scale of the element

quadrangle is set and exposure takes place. Apertures moved with electronically controlled motors carve out the size of the element quadrangle from the light ray and optics corrected to UV light produce the image on the photo sheet with a reduction of ten. The precision of the first photograph figure is 0.25 microns. This means that after reduction of the 10 x scale first photograph to 1 x even with 0.1-0.2 micron figure faithfulness one can ensure element quadrangle coordinate precision of 0.025 microns which corresponds to the requirements of the 2.5 micron technology.

The precision of the Optical Pattern Generators makes possible the preparation of first photographs of IC's produced in the most modern mass manufacture; their speed (slowness) causes a problem when preparing masks of LSI's and VLSI's containing several thousand circuit elements, where the time for preparing the first photograph may require 8-10 hours or even more. In most cases this problem can be gotten around by preparing composite masks--at the price of performing extra operations--but a reassuring long-term solution can be provided only by acquiring an Electron Ray Mask Generator, which is many tens of thousands of times faster and even more precise.

b. Stepping-repeating cameras: Soviet machines. They have the same structure and precision as the Optical Pattern Generators. They produce 1 x x scale pictures from the 10 x scale first photograph--repeating about every second--one beside the other or one under the other. The picture of each chip (the first photograph contains this) is placed on the master mask with a precision of 0.25 microns. One can ensure a precision of 0.25 microns even among chips at a distance of 100 mm, which is suitable for the production of master masks of wafers with a diameter of 75 and 100 mm, that is for the preparation of master masks for LSI's and VLSI's.

They have the special advantage that they are also suitable for the preparation of composite masks for large circuit element number IC's.

The MPA-500 FA matching device (of Japanese manufacture). Use of this projection system mask matching illuminator means a breakthrough in the direction of micron technology.

This machine performs 1:1 scale imaging with a mirror optical system. The size of the smallest circuit element which can be imaged is 1.5 or 1 micron with UV or deep UV illumination respectively.

The silicon wafers to be processed have a diameter of 76, 100 and 125 mm. Mask matching is automated using a scanning laser ray and special matching figure and has a precision of 0.15 microns.

It is a further advantage to the use of the MPA-500 FA that matching illumination for several thousand wafers can be done from a single mask, thus the master mask can be used as a work mask, and the cost of making work masks and the waste deriving from work mask damage are avoided.

It will be possible to satisfy the most demanding domestic needs with the matching-illuminating machines of the MEV.

c. Contact copiers. American products. These are used to prepare work masks from the master mask. They satisfy the most modern requirements and can be used to prepare 2.5 micron technology work masks as well.

d. Mask matching-illuminators. The Soviet made EM-576 A.

EM-576 A (Soviet made) matchers. These precision machines work in the contact and proximity mode. They are suitable for matching--illuminating--silicon wafers with diameters of 60, 76 and 100 mm. They have a matching precision of 0.5 microns; the minimal circuit element size which can be imaged is 1.5-2 microns in the contact mode and 3-4 microns in the proximity mode.

According to the parameters of the machines and the operational experience acquired with them they are suitable for cultivation of the 2.5 micron technology in the contact mode. But the contact mode represents a great burden in the direction of work mask manufacture because after a few matchings the damage to the work masks is so great that they can no longer be used.

e. Photolithography machines. The LADA 125 Soviet made machine line for uniform deposition, drying and, after illumination, development of the photo lacquer.

This machine line is equivalent to the photolithography machine lines widely used by leading western semiconductor manufacturers.

It provides touch-free (cassette to cassette) automated handling and processing of the wafer. It is suitable for processing 76 and 100 mm wafers.

The parameters of the photolithographic operations can be programmed, the machine units are electronically controlled. The machine line is supplemented with units which load the wafers into the cassette and make a visual check of the wafers being removed. The operational experiences acquired with the LADA 125 machine line prove that it is suitable to perform the most demanding photolithographic operations.

f. Wet chemical etcher. The LADA I Soviet made wet chemical line assembled in laminar cabinets to process silicon wafers with a diameter of 76-100 mm. This line is suitable for etching various layers (silicon oxide, nitride, polysilicon, aluminum, etc.), removing the photo lacquer and cleaning the wafers. The cheap wet chemical operations well proven in mass manufacture and used widely today still give outstanding results in the case of technologies where the minimal pattern size is not smaller than 5-6 microns. They are less useful, or not at all useful, for technologies finer than 5-6 microns. Considering that more than 80 percent of the estimated circuit needs will be made with the 5-6 micron technology, the LADA I wet chemical manufacturing lines will provide good service in the future also due to their reliability and cheapness.

g. Plasma etchers. The MEV has Soviet made cylindrical and flat plasma equipment. Both types are suitable for processing 76 and 100 mm diameter wafers.

The cylindrical plasma equipment is used for the complete removal (from the oxide layer) of photo lacquer and photo lacquer remnants and silicon nitride layers.

The flat plasma etcher is used for the prescribed etching of the silicon nitride and polycrystalline silicon layers.

The plasma etchers are suitable for layer etching of 2.5 micron and finer technologies. The MEV must expand its plasma etching machine park to the etching of oxide and metallizing layers also in order to be able to reliably cultivate the 2.5 micron technology.

h. Ion implanters. The MEV works with MBP 202 medium current and SCANIBAL SCI 218 large current ion implanters made by Balzers. The most demanding doping operations can be done with this modern equipment.

i. Chemical gas phase layer deposition (CVD). The MEV has a number of types of CVD equipment. Of these we should mention the two most modern ones, the PSVD type made by ASM (Holland) and the PE 861 epitaxial reactor of Timesa (a Swiss firm).

The  $\mu$  PCVD is a completely automated CVD reactor equipped with electronic process control which is suitable for the exercise, reproducible performance of the most common layer building operation of the MOS technologies--silicon nitride, polysilicon, high temperature oxidation, low temperature doped and undoped oxidation, TEOS oxide.

The PE 861 vertical epireactor makes possible the production of epitaxial layers in a broad layer resistance range (0.1-80  $\Omega$  cm) and layer thickness (3-150 microns) occurring in the most modern bipolar integrated circuit technologies.

These two CVD reactors greatly aid the cultivation of the most modern MOS and bipolar technologies.

j. Physical layer deposition. The MEV has a number of outstanding quality, western made vacuum vaporization and cathode sputtering devices. These include the BAK 760 Process System (made by Balzers), which is suitable for various types of vacuum vaporization and magnetron atomization, and the Z-600 high performance magnetron cathode sputtering device made by Leybold-Hereus, which is also suitable for creation of sandwich layers. These two modern devices make it possible to produce the metal layers or layer structures occurring in the finest MOS and bipolar technologies.

#### Evaluation

When judging the "modernness" of the equipment park we must examine additional factors, beyond a classification of the several machines--for example, what sort of environment the machines are operated in, the quality and continuity of the necessary services (ion water, pure gases, etc.) and with what sort of technology the circuits needed by the electronic industry might be prepared.

The technological machines are installed in an outstanding environment. An English firm world famous in this area designed, delivered and put into operation the high purity operations area, the clean room system and the supply of pure air.



A Swiss firm, a leader in this area in Europe, delivered and installed the system supplying high purity ion water. And we entrusted the best western firms with delivering or providing the equipment necessary to produce the pure gases--nitrogen, hydrogen and oxygen.

We have provided measuring instruments and equipment of the best quality accessible, most of it of American manufacture, to grade and check the technological operations and the materials used.

It is the unanimous opinion of foreign semiconductor experts that an infrastructure which can be called outstanding aids the operation of an outstandingly good wafer technology machine park. Everything has been provided so that the MEV should cultivate the 5-micron technologies economically in mass manufacture, and it is also ensured that it will produce circuits for the 2.5 micron technology in smaller series.

A distribution according to technologies of the manufacture of integrated circuits in the capitalist world, leading in the manufacture and use of IC's, shows that today 75-80 percent of the circuits manufactured (and used) by them are produced with a 5-micron technology, 10-15 percent with a 2.5-micron technology, and 5-10 percent with technologies cruder or finer. It is probable that the domestic user electronics industry will not require a larger proportion of circuits made with a 2.5 micron or finer technology in the near future.

If we accept the above hypothesis the wafer technology machine park and plant of the MEV can be regarded as modern.

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HUNGARY

## PROGRESS, GOALS IN BIOTECHNOLOGY SUMMARIZED

Budapest NEPSZABADSAG in Hungarian 13 Mar 85 p 5

### [Excerpt] Selective Program

The new biotechnology is offering very abundant promise, its development is dynamic and quite multifaceted. Of course, domestic development cannot be based on seeking goals which exceed our possibilities. It is a considerable success if our biotechnological products can supply most of our own needs and our position is not weakened on the export market. In order of value, the following are currently appearing on the market: in the first place medical products, antibiotics and vaccines followed by industrial fructose syrups and single-cell proteins; among the basic materials of the chemical industry and enzymes, amino and organic acids, and additionally, biofuels and agricultural seed stocks (virus-free seed potato and fruit grafts).

This already allows us to see how broad and multifaceted biotechnological application is; it extends to the chemical industry, the pharmaceutical industry and also agricultural and industrial production in general, in addition to plant and animal breeding and therapy. It not only includes these but also renews them. It is also obvious that we are forced to apply stringent selection among domestic biotechnological research and production tasks according to the program worked out by the Hungarian Academy of Sciences, the OMFB [National Technical Development Committee] and the ministries involved. It is important to keep in mind here that--as we mentioned before--biotechnology is collective knowledge and, in practice, forms a chain of innovations which must not and cannot be disrupted under the guise of selectivity. Because where only the biotechnological industry, the factory or workshop is being supported unilaterally, neglecting research, production will also be irreparably left behind. And where research is favored unilaterally, the results of costly research will be poorly utilized in the absence of domestic production possibilities.

### Pharmaceutical Industry in Vanguard

In domestic biotechnology, on the practical side, pioneering projects have been found mostly in the pharmaceutical industry. As a result, the greatest possibilities are becoming available in the export of drugs produced through biotechnology. In Hungary, penicillin production using fermentation technology was started at the Chinoín Pharmaceutical House and a scientific

basis for production was later established at the Biogal Pharmaceutical House in Debrecen, recognizing this as the only means of increasing production in an economical manner and, at the same time, increasing the chances of selling their products.

The Pharmaceutical House of Kobanya is also standing on the threshold of a significant venture: it is in partnership with the Biology Center of Szeged in future human insulin production. This, however, requires further research involving the metabolic processes of microbes and the elaboration of their regulation by computer.

This problem was solved, for the first time in Hungary--earlier than in many other countries--at the Department of Agricultural Chemical Technology of the Technological University of Budapest early in the 1970's. The importance of their findings was enhanced by the use of their laboratory computer system demonstrating the fruitful interaction between the biotechnological and electronic revolutions. Adopting the system technology of the Technological University, the Biogal Pharmaceutical House is now working on its own development of basic semi-industrial equipment jointly designed with the Atomic Research Institute of the Academy. Following its example, the majority of our domestic pharmaceutical houses are setting up similar computer system technologies for data collecting and process guidance.

#### Outstanding Results

But we also have outstanding results or initiatives, which can be built upon in the future, in plant and animal production, in the food and chemical industries, in human medicine and gene splicing, in microbiological protein research and even in the use of microorganisms for ore exploration and enrichment. Our current results are promising, for instance in the production of microorganisms altered by gene splicing which bind nitrogen on the root system of plants thereby possibly lowering or eliminating the demand for chemical nitrogen fertilizers. Related domestic research belongs in the vanguard of the world. Nevertheless, the greatest expectations surround the domestic production of human insulin. At the Biology Center of the MTA [Hungarian Academy of Sciences] in Szeged, while carrying out gene splicing, the bacterium strains needed for it have already been produced. Although we are still relatively far from industrial-scale production, nevertheless we have gotten much closer than we were a few years ago, according to the experts. We stress this fact because the results achieved so far already indicate that, where domestic science is present and is provided with adequate possibilities, we can count on significant practical results.

#### Training of Specialists and Scholars

Our governmental program for biotechnology also provides for a more intensive training of specialists. In the absence of such a program development of our technological foundations and elimination of the relative backwardness in certain areas of biotechnology cannot be accomplished. This has long been

recognized abroad. For instance, the British Government contributes 800,000 pounds to biotechnological research at the universities, and to training specialists and raising the young generation of scientists because it considers it not only necessary but also advantageous from the aspect of the British national economy.

The two domestic citadels of training have been the Biology Center in Szeged and the Technical University in Budapest. At the Technical University, the training of biological engineers has been going on for over 10 years and the advanced training of specialists will begin this year. The universities of Szeged and Debrecen have not fallen behind and the training of biotechnologists was recently started at the Faculty of Natural Sciences of ELTE [Eotvos Lorand University] with the participation of several departments. The "only" thing missing is that, commensurate with the extent of the task and the beauty of biotechnological subjects, an increasing number of young people should discover for themselves, as their future profession, the promising areas of biotechnology. We need now and we will especially need in the future specialists who have adopted from their predecessors not only knowledge but also the spirit whereby the domestic pioneers of the "specialty" have laid the foundations of progress for this science and a receptiveness toward practical application.

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HUNGARY

DEVELOPMENT, ESTABLISHMENT OF TELEPHONE SWITCHING IN HUNGARY

Budapest HIRADASTECHNIKA in Hungarian No 11, Nov 84 pp 484-488

[Article by Frigyes Berecz of the BHG [Beloianisz] Communications Engineering Enterprise: "Appearance and Spread of Electronic Switching Technology in Hungary"; a paper read at the 1 Nov 84 scientific session of the Hungarian Academy of Sciences]

[Excerpts] Summary

The article describes the history and achievements of the domestic development of electronic switching technology. It calls attention to the achievements of the first period, between 1957 and 1977, which are forgotten or which evoked little response, to the failures and the causes of them. It then calls attention to the successes of the consistent development period beginning in 1977 and still characteristic today, and on the basis of this to the future possibilities for the development of domestic telecommunications.

The Electronic Period

By 1981, still in the period of quasi-electronic subexchanges and exploiting the results achieved here, the first member of the EPEX subexchange family, fully electronic and with analog switching, was prepared in a very short time. This was the medium capacity (100-400 line) EP 128. The crucial difference between the QA and the EP was in the design of the switching field. In the latter this was done with the dielectrically insulated technology using monolithic circuits containing thyristors. Each IC contains a switching matrix consisting of 4x4x2 crosspoints; each 16x8x2 capacity, three stage backlooped switching field block consists of 12 IC's. With use of these the dimensions of the exchange were reduced to one half compared to the QA (and to one tenth of the crossbar subexchanges).

The 32 and 64 line EP 32 and EP 64 and the large line number EP 512 (400-6,000 line) subexchanges were prepared during 1982-1983 also, in addition to hotel exchange versions. Between 1981 and 1984 total sales exceeded 100,000 lines--with a dynamic development of production. Significant additional sales for a number of years are probable on the basis of the orders existing.

The EPEX family won a gold medal in Leipzig in 1982 and the EP-512 won the grand prize at the Budapest International Fair in 1983.

Development of the DIPEX digital subexchange family began simultaneously with that of the EPEX family. The DP 20 and DP 50 model 20 and 50 line single bus versions had been prepared by 1983. Of these, the DP 50 was put into test operation at the beginning of 1984 and series manufacture of them will begin at the end of 1984. The DIPEX family will be complete with the DP 100, and development of it will be completed by 1985.

Stored program control of the digital subexchanges was solved with an 8 bit microprocessor and the design makes self-testing possible also. Line codes and a 2 Mbit/s speed primary PCM bus make up the distributed switching field; thirty time slots transmit speech links and of the two special time slots one transmits calls coming in to the operator and the other transmits tone signals. Since switching is four line switching, 15 simultaneous conversations are possible at most.

On the basis of its parameters the DIPEX system makes possible the introduction of electronic services for business and office communications. Later it will be possible to develop house exchanges, public network terminal exchanges and four wire transit exchanges also.

Development of the PRS system (PCM Rural System) began at the TKI [Telecommunications Research Institute] in 1981. The goal was the development of a complex, digital distributed rural and suburban telecommunications system to be connected to the higher levels of the existing network. The switching technology has relatively little importance in this system; it is realized by PRC switching and control equipment. Since a detailed description of the PRS system was given at the 2 May 1983 scientific session of the Hungarian Academy of Sciences, we will not go into the details.

Despite the swift spread of electronic telephony, nearly 90 percent of the some 600 million lines in operation in the world today are still linked to electromechanical telephone exchanges. The device value of these is extraordinarily high; it may be decades before all of them are replaced by modern digital exchanges. Until then many sorts of systems will be forced to work together, and this will make ever more urgent an increase using electronic devices, in the operability and reliability of traditional exchange systems.

Recognizing this fact, the BHG began in 1981 to develop equipment with which it would be possible to provide continual control and supervision of telephone exchanges with any sort of system and with which one could solve the collection, systematization and evaluation of data for the purpose of later intervention. This system is the LOTRIMOS (Local and Transit Remote Integrated Measuring and Observation System, or the integrated operational control system for local and long-distance exchanges) within which they developed the LIMOS intelligent terminal for local exchanges and the TIMOS for transit exchanges, which are capable of independent

operation--linked with the given exchange--providing supervision of individual installations. A supervisory system for each sector network can be put together from the terminals, a system for a node network can be put together from these, and finally an integrated supervisory hierarchy for the telecommunications network of a country can be assembled. In the nodal points the LOTRIMOS regional exchange receives the data and processes it with the aid of a CPU on behalf of the various supervisory and maintenance offices. (These can be: Operations and maintenance; Traffic administration; Service quality control; Accounting; Maintenance of transmission channels; and Handling of subscriber complaints.)

Combined supervision of mixed networks made up of traditional and digital systems is also possible.

With full development of each subsystem terminal it is possible to connect to 32,000 measuring points, which can be ordered into groups with software tools. Scanner processors sense the signals received from the measuring points and these transmit to the control processor the signals indicating a change in state. These follow the operation of the circuits being measured and activate the statistical counters. There are one each scanner and control processor per 2,000 points (per terminal cabinet); the system bus collects their outgoing signals and passes them on for storage or processing. The peripheral processor controls this process.

The system executes the instructions of the operator--locally or at a higher level--through the operator processor. The system operates data collectors and displays to facilitate the link. The terminals are capable of self-testing with automatic error indication. Faults in the exchange being supervised can be established by mechanical means with very great precision and thus routine tests can be omitted. It is capable of continual traffic measurement and efficiency ratio measurement, can take over the task of fee recording and accounting and can supervise public telephones. Connected to exchange systems it can carry out some of the tasks of network control also.

A 5,000 measuring point terminal put into operation in 1983 at the Budapest international long-distance exchange and a 24,000 measuring point terminal put into operation in 1983 at the Dresden long-distance exchange prove its practical utility. LOTRIMOS won the grand prize at the Budapest International Fair and a gold medal at the Brno exhibit in 1984.

#### Closing Thoughts

According to what has been said, the Hungarian communications industry, beginning in 1981, began manufacture or reached a reassuring level of development with its systems. With the EPEX and DIPEX subexchange families and with the LOTRIMOS operations supervision system it solved, or will solve within one or two years the electronization of switching technology for a considerable part of the entire telecommunications system at a high technical level, proceeding on new, independent paths.

If we also take into consideration a few developments under way about which we have not spoken in detail--such as the PRS rural system, the EP hotel exchanges, the EPK rural exchanges and the FT electronic chief secretarial equipment--it can be said that the electronization of switching technology has begun in our country and is proceeding in a good direction. (By the end of 1985 the number of lines of electronic subexchanges operating in the Hungarian People's Republic will reach 100,000 lines--7 percent of all operating lines.)

Despite all this we must face the fact that even with its united strength Hungarian industry would not be capable of carrying out the developments of greatest importance, the development of large line number urban and large trunk number long-distance exchanges meeting the ISDN requirements. Thus, in addition to an energetic continuation of domestic development, there continues to be a need for development of an ISDN system, with the united efforts of the socialist countries, and for the purchase of a new license.

At its meeting in Sofia on 2 July 1981 the CEMA Executive Committee passed a resolution for joint development of the Uniform Switching Technology System (EKR). (Similar resolutions are valid for the development of the Uniform Digital Transmission Technology System--EDAR--and the Uniform Mobile Service UHF Radiotelephone system--EMUR.) The EKR will be a stored program, microprocessor, distributed control, digital system. Development will be completed around 1988. The member countries must develop not only the system but also the necessary material and parts background.

In addition to all this Hungarian industry is preparing to purchase another license--primarily to meet the domestic needs of the Hungarian Post Office and the multiple relationship foreign market competition requirements. In 1981 the Hungarian Post Office, the Budavox Company and the BHG called for bids, received a number of bids to evaluate and performed the evaluation of them. The decision will be on the agenda this year. But according to a July 1984 resolution of the COCOM countries the sale of equipment and technology to socialist countries can be authorized only after 1 January 1988. Thus the Hungarian communications industry can start manufacture in the last year of the Seventh 5-Year Plan at the earliest. This decision gives even greater emphasis to the importance of domestic developments. Both the license and the domestic developments will require the solution of very difficult but extraordinarily important tasks not only from the BHG but from at least 10 other Hungarian enterprises--and primarily from the Microelectronics Enterprise. If adoption of the license is finally realized, together with products developed domestically, the possibility for taking new paths, both quantitatively and qualitatively, will be offered for the development of domestic telecommunications.

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HUNGARY

## TRENDS IN TELECOMMUNICATIONS R&D IN 1986-1990

Budapest HIRADASTECHNIKA in Hungarian No 11, Nov 84 pp 489-492

[Article by Dr Gyula Tofalvi, of the Telecommunications Research Institute: "Chief Trends of Our Telecommunications Research and Development in the Years 1986-1990"; a paper read at the 1 November 1984 scientific session of the Hungarian Academy of Sciences]

### [Text] Summary

The author first summarizes the chief results--to be expected--of telecommunications R&D done during the Sixth 5-Year Plan. He then reviews the chief goals of work for the years between 1986 and 1990. He outlines the R&D conception for the period of the Seventh 5-Year Plan analysed by the theme areas for systems technology, switching technology, transmission technology, terminal equipment technology and space telecommunications.

Dr Gyula Tofalvi

He studied at the Budapest Economics Science University and then at the Budapest Technical University. He earned a degree in electrical engineering in 1954. Between 1954 and 1975 he worked at the Electromechanical Enterprise, where he was a researcher, developer, laboratory leader, chief of the developmental main department and enterprise chief engineer. At this time his theme areas were medium, short and UHF transmitting equipment and antenna systems, black and white and color TV transmitters and stereo quadrasonic transmitters. Between 1975 and 1980 he was technical vice president of the Hungarian Communication Engineering Association. In this period he dealt with the development of the Hungarian electronics industry and, within this, with the stressed development of the communications engineering industry and the parts industry. Since 1980 he has been scientific director of the Telecommunications Research Institute. He was awarded the Kossuth Prize in 1959. In 1979 he became doctor of technical sciences. In 1981 he received the degree of titular university professor.

### 1. Introduction

When developing our telecommunications research and development conception for the period of the Seventh 5-Year Plan the first and most important

fact which we had to take into consideration was that our development, and our R&D therein, is a process in which, despite local and periodic outstanding achievements, only parts will be completed with the end of the Sixth 5-Year Plan and only parts will begin with the start of the Seventh 5-Year Plan. Every essential thing which has happened or which will happen is part of a process which began many years ago and which will last for many years to come.

This is also shown by the fact that those tasks which we want to put into the center of our conception in the Seventh 5-Year Plan were in part recognized even at the time of compiling the program for the Sixth 5-Year Plan and were in part formulated in the course of the work of the Sixth 5-Year Plan.

We might take digitalization as a basic example; this appeared in our R&D many years ago and it will last for many decades hereafter. Another example might be our R&D work connected with satisfaction of analog/digital compatibility, which has figured in our R&D work for a long time and which will go on for decades.

In regard to our telecommunications R&D work during the Sixth 5-Year Plan I would like to mention only briefly that it was a creative, successful, beautiful period in the life of our telecommunications industry as a result of which we developed systems and system component equipment which ensure realistic domestic conditions, at the beginning of the Seventh 5-Year Plan, for liquidating the serious backwardness of the Hungarian telecommunications network and for the gradual digitalization and further development of the network. In the wake of the telecommunications R&D of the Sixth 5-Year Plan we have developed digitalization and a convergence of computers and communication; the first stored program controlled small and medium capacity exchanges and PCM transmission equipment with various signal speeds have been developed; the first optical transmission links are being realized; new families of microwave equipment have been developed; various themes of information transmission using satellites have finally become a factor in our R&D; and we have developed modern suburban, rural and subscriber network systems, in landline and radio solutions, which provide a comprehensive background for domestic network development, and going beyond this will aid, with the creation of a modern export commodity base, a further development of the industrial level we have achieved thus far.

I will review the chief directions of our telecommunications R&D for the years 1986-1990 in the following chief theme areas: systems technology, switching technology, transmission technology, terminal equipment technology and space telecommunications.

## 2. Systems Technology

The chief directions of development continue to be determined by digitalization and the convergence of computers and communication, for which a further swift development of microelectronics creates a realistic foundation.

Our telecommunications R&D work will provide two great integrations in the years ahead: the integration of the network and the integration of telecommunications services.

Network integration will proceed in a lawful way with the spread of digitalization; at the same time, the integration of services is a substantially slower process--with the exception of model systems and model networks--because it is substantially more difficult to satisfy the system of conditions for this.

Model systems and model networks realizing integrated service are parts of deliberate, progressive R&D work, but the general spread of integrated service is determined by a multiplicity of social, economic, sociological, etc. factors the development of which is a substantially slower process than making a decision to create model systems and model networks, providing the necessary conditions for creating them and carrying out the R&D work to be done.

The first phase of the service integration being realized in telecommunications networks is development based on exploiting the possibilities given in the analog base networks, the level of which differs from country to country, considering that the level and characteristics of the base networks are different also.

One can regard as the second level of development an expansion and integration of services based on exploitation of the possibilities given in already operating digital base networks which make possible the given service integration.

The third level of development takes place in the course of a further development of the digital base networks, when new transmission media, new transmission procedures, new transmission paths, etc. begin to be used.

On the basis of the foregoing we can judge the realization of integrated service as follows. We can count on a jump in development in the area of model systems and model networks; a relatively swift development will be realized in those countries where the level of the base networks favor telex, data, still picture, etc. transmission in addition to telephone service; and we can predict a very slow development, with an interval of a decade, for the realization of general service integration, which can come into being only at the rate that a further development of the networks takes place.

It is characteristic of the level of realization of model systems and model networks that they are already based on transmission with the aid of light, creating band width and interference protection conditions for transmission which open a very wide gate for expansion of services and their integrated transmission.

Domestically we must start from the fact that today we have a very backward base network which allows the expansion and integration of services in only a few partial areas.

Putting our base network in the balance it can be said that even telephone service is not solved at an adequate level in it. In this case I am not thinking of how broad the service is or what the quantitative level of the service is but rather of the level and quality of service the present network makes possible for subscribers already connected.

In sum it can be said that we must realize our service development and service integration aspirations in the domestic network with the following gradual stages:

1. Increasing the level of the base network, primarily raising the telephone service to the European level;
2. Expanding and integrating services in those domains where the base network makes this possible;
3. Realizing a broad service expansion and service integration in the wake of new network developments.

During the Seventh 5-Year Plan we must put our R&D work primarily in the service of the second and third tasks, because in this way we can best aid our own development, naturally if we accept the thesis that in the wake of the R&D and license use work done in the Sixth 5-Year Plan we have created the system and equipment base for a development of the Hungarian base network.

Even during the Sixth 5-Year Plan we could find in our systems technology R&D some themes whose practical application probably will not take place in domestic network development even in the Seventh 5-Year Plan period (for example, SCPC equipment). Still these R&D tasks are essential because even at a time of the progressive development of the domestic network the export orientation of our telecommunications industry remains and we must construct our R&D program even for the years 1986-1990 so that, in addition to the maximum possible satisfaction of domestic network development needs, we will be able to satisfy those requirements which are to be solved in the interest of our export aspirations. In the years 1986-1990 we too must concentrate the R&D forces and assets available to us on our crucial tasks, and in the future we too must reckon with the fact that we must import some equipment for the development of the domestic network and for our export deliveries, in order to develop complete systems.

The chief tasks of R&D connected with a further development of telecommunications systems and networks can be designated as follows for the years between 1986 and 1990:

- Creating new systems and system components to create an integrated service digital base network;
- Developing versions of complex subscriber and rural systems with expanding automation and increasing services, in landline, wireless and combined solutions;

--Developing and putting into use complex digital systems and networks providing new telecommunications services.

The chief tasks of R&D work serving a further development of the systems worked out during the Sixth 5-Year Plan are:

a. In the area of a time-sharing subscriber radio system:

--An expandable design with repeating and/or branching stations, with the possibility of subscriber connection at all stations. Increasing the range. A cell system structure, to increase the area served;

--Exploiting the transmission possibilities above 10 GHz (for example, 15 GHz);

--Expanding the capacity of the base system to 128 subscribers;

--Developing teletype or data transmission terminals, making use of low speed data transmission channels;

--Studying the possibility of use in a data base network;

--Direct connection to digital telephone exchanges.

b. In the area of PCM based integrated digital telecommunications systems:

--A further development of services; partly for transmission of telex and data signals and partly to expand other services to be offered the user;

--There may be an expansion of services in the large city version of the PRS system and development of a PRS/M rural system version to be connected to ARM exchanges.

c. In the area of a further development of the UHF rural telecommunications system:

A further development of the CSL message system, expanding the base system with new services and introducing new systems technology principles. Expanding services will involve insertion of dispatcher lines and special line terminals, building in the software functions necessary for organization of a mobile service system, and extending the sphere of administrative and maintenance services.

New systems technology principles means primarily introduction of the so-called cellular UHF message service being developed throughout the world. This is aimed at introducing services not used thus far in regard to the base system, such as tracking and keeping records on mobile subscriber stations, seeking the called station in the various UHF cells, connection to stored program controlled public telephone exchanges and use of UHF radio subscribed stations provided with expanded services.

### 3. Switching Technology

The chief directions for switching technology R&D, that is for the further development of equipment, are:

- digitalization;
- increasing integration with transmission technology;
- the convergence of computers and communications;
- a swift expansion of services;
- a general spread of automatic supervisory control and maintenance systems;
- maximal exploitation of the possibilities offered by microelectronics.

The R&D tasks for the theme area in the Seventh 5-Year Plan are:

- Adopting and beginning manufacture of stored program controlled, time-sharing telephone main exchanges;
- Stored program controlled analog and digital system telephone subexchange solutions, further development of rural and suburban exchanges and an expansion of services;
- Creation of versions of operations supervision systems suitable for stored program controlled and optional switching equipment and expanding their services.

In the course of the development of digitalization the basic requirement to be made of all exchanges will be that they gradually satisfy the requirements of an integrated telecommunications service, without regard to whether we are talking about a subexchange or a main exchange. For example, in regard to subexchanges, we must think about creating an information service constituting a closed system which will gradually include the transmission of voice, data, pictures, writing, etc.

So domestic R&D must be concentrated primarily on the theme areas of rural, suburban, subexchange and operations supervision systems and on expanding the services of them and this work must be coordinated with the work of adopting a possible main exchange license.

### 4. Transmission Technology

Our transmission technology R&D extends to three large theme areas and will do so in the years 1986-1990 also. These are: landline, wireless and optical transmission.

In these theme areas also the chief trends of development find expression primarily in a further spread of digitalization, in computer and

communications convergence, in the spread of the use of microelectronics, etc.

Our R&D to be done in the area of producing transmission technology systems and system components can be summed up briefly as follows:

In the case of landline, wireless and optical transmission systems and system components alike one of the chief goals is a complete solution of R&D connected with 140 M bps transmission, developing the equipment connected with this, and carrying out the basic research connected with 560 M bps transmission.

We might include here completion of the unfinished R&D connected with 34 M bps and 2x34 M bps signal transmission.

Another comprehensive R&D task extending to all three theme areas is development of new solutions and new equipment connected with packet switching data transmission.

Yet another comprehensive R&D task affecting all three theme areas is carrying out the R&D tasks connected with analog-digital transmission and analog-digital long-range compatibility.

Other R&D goals appearing in the theme area of wireless (radio) transmission include:

- Making the already developed microwave equipment family used for analog signal transmission under 10 GHz suitable for digital signal transmission;

- Developing analog-digital microwave equipment operating in the 1-2 GHz and 10-20 GHz ranges;

- Circuit, transmission procedure and technological R&D to develop microwave equipment operating in the 20-30 GHz range suitable for transmission of PCM signals at speeds of 140 M bps and faster;

- Development of multipurpose, simple, cheap, autonomous power source, digital microwave equipment in the 8-18 GHz range;

- R&D on new antennas, antenna systems, feed lines, feed line elements, etc. in the 1-30 GHz range;

- Further development of auxiliary equipment, etc.

A few additional R&D goals appearing in the theme area of optical systems and system components are:

- Line section equipment for transmission with a signal speed of 140-560 M bps in the 1,300-1,600 nm domain;

- Applications technique R&D for atmospheric optical transmission at signal speeds slower than 1 M bps;

--R&D connected with line section equipment for broad band subscriber, optical links.

In the theme area of VHF/UHF radiotelephone systems and system components the chief directions of R&D are determined by extending the frequency range to 900 Mhz, a further development of free channel access, use of packet communication, extending the use of concentrators, realization of cellular transmission, expanding data transmission services, developing equipment using new solutions, etc.

#### 5. Terminal Equipment Technology

Despite the fact that in this theme area, in the years 1986-1990 also, the chief domain of our tasks is determined by R&D connected with telephone sets, we must already take into account the R&D tasks for terminal equipment of increasing intelligence which can be connected to data transmission networks, telecommunications service integration, optical fiber transmission, etc.

In the area of telephone sets the chief directions of R&D are determined by tasks connected with increasing the parameters, expanding the services, development of microprocessor coin operated sets, etc.

#### 6. Space Telecommunications

It seems necessary to mention two tasks in this theme area: R&D connected with 12 GHz broadcast earth receivers and R&D connected with digital channel generating equipment (SCPC).

Equipment solutions satisfying the system of requirements for individual reception represent the chief task in the further development of a 12 GHz earth receiver while an expansion with new solutions of the results already achieved provides a program in the area of large and small community reception.

Realization of free channel access, development of microwave transmitter-receiver equipment, working out data transmission solutions and realization of music sound transmission provide the chief directions of our work in the INTERCSAT R&D done in Soviet-Hungarian cooperation.

#### 7. A Closing Thought

In the time allowed I have been able to only outline the chief R&D goals for the coming 5 years of our telecommunications industry. But even from these one can sense what magnificent years await us, the researchers, if we are able to ensure the system of conditions in which such a beautiful, creative program can be realized.

In regard to the system of conditions let me mention the high level of supply of primary materials and parts absolutely necessary for research and development. At the time we were developing our R&D program this



supply fell to never before experienced depths. So I feel it my obligation, in this case also, that my closing thought should be to take a stand for the absolute necessity of emphatically developing the domestic primary materials and parts industry!

8984

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HUNGARY

#### FAMILY OF SMALL CAPACITY DIGITAL SUBEXCHANGES DEVELOPED

Budapest HIRADASTECHNIKA in Hungarian No 6, Jun 84 pp 241, 246

[Article by Imre Horvath, Developmental Institute of the BHG Telecommunications Enterprise: "Family of Small Capacity Digital Subexchanges Developed in Hungary"; from material presented at the ISS in Firenze, 1984; manuscript received 7 Mar 84]

#### [Excerpts.] Summary

In a brief summary we give a general overview of the developmental activity, of almost 30 years, which the BHG [Beloianisz Telecommunications Factory] has conducted in the areas of subexchanges.

This activity led, through electromechanical exchanges, electronically controlled crossbar exchanges, wired program controlled analog electronic exchanges and stored program controlled analog electronic exchanges to the development of the first Hungarian family of microprocessor controlled digital subexchanges bearing the model name DIPEX.

The article devotes a number of thoughts to the developmental process for the digital subexchange family mentioned which began in 1979 with a determination of the goals and which reached an important phase in 1983 with the demonstration of the system at the Telecom '83 exhibit in Geneva.

#### Future Developmental Plans

We want to continue our developmental activity in several directions on the basis of the results achieved in the course of developing the subexchanges. One of the most important of these is the development of an interface which will link the DIPEX system to an economical system with a small number of channels using the PCM transmission technique. We are conducting feasibility studies in this area which suggest a reassuring future for a solution by the time digital main exchange systems appear in our country.

Another direction of digital subexchange development is extending the capacity range in the direction of a larger number of lines.

Although we see clearly that the trend is increasingly in the direction of digital service integration we will concentrate our efforts on the above areas in the years ahead.

#### Conclusions

With the development of the first Hungarian microprocessor controlled digital subexchange family, the DIPEX system, the BHG has become capable of satisfying the most refined subexchange needs of the near future, including business communications services.

After a successful cycle of tests and the successful demonstration of the system at the Telecom '83 exhibit in Geneva, manufacture of the DIPEX system began at the BHG in 1984.

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HUNGARY

U400 GATE ARRAY, DESIGN METHODS

Budapest HIRADASTECHNIKA in Hungarian No 7, Jul 84 pp 295, 300

[Article by Pirooska Szentpeteri and Ferenc Heksch, Microelectronics Enterprise: "The U400 Gate Array and the Design Methods For It"; manuscript received 23 Nov 83]

[Excerpts] Summary

The U400 gate array is one of the MOS LSI equipment-oriented circuits of the MEV [Microelectronics Enterprise] with the most varied uses. Its structure is extraordinarily simple and can be easily learned by any design engineer with experience in digital design. A complete system of graphic and computerized aids makes possible the design of equipment-oriented circuits on the U400 without the designer having any but the fundamental experience in designing integrated circuits. After a brief description of the U400 the article describes the designing process and the system of designing aids supporting it, with special regard to the user-manufacture link.

Conclusions

We have seen that the Microelectronics Enterprise makes available to the user, in every phase of designing, very efficient aids for designing on the U400 gate array in order that the user can assure an ever larger part of the designing process. This is in the interest of the user, who in this way can significantly shorten designing time and save a significant part of the development cost. The graphic and computerized aids are summarized in Table 9. Finally, we should emphasize the significance of maintaining constant contact between the MEV and the user. This is a precondition for efficient cooperation even if the MEV does the designing in its entirety and it has special importance when the user assumes a larger or smaller part in the designing.

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HUNGARY

## PRODUCTION OF NICKEL THIN FILM REACTORS WITH CHEMICAL REDUCTION PROCESS

Budapest HIRADASTECHNIKA in Hungarian No 8, Aug 84 pp 353, 359

[Article by Dr Mrs Gabor Bessenyei and Dr Bela Zsoldos of the Microelectronics Enterprise and Mrs Tamas Geszti of the Technical Physics Research Institute: "Production of Nickel Thin Film Resistors With a Chemical Reduction Process"; appeared in English in the journal VACUUM, No 1/2, Vol 33, p 35; manuscript received 1 Feb 84]

### [Excerpts] Summary

An amorphous Ni-P film was prepared with separation without current. The electric properties (quadratic resistance and temperature coefficient) of the resistance layers deposited on ceramic and glass carriers were studied. The structure of the layers was studied with transmission electrodiffraction. A relationship was found between the structure and the electric properties. In addition, there was a study of the effect of heat treatment at different temperatures on the electric properties of the resistance layers.

### Conclusions

We developed a method suitable for the creation of thin film resistors using a chemical reduction process. The layers produced with this method adhere well to glass and ceramic substrates. The production of them is relatively simple and cheap because it does not require vacuum equipment, in contrast to most methods for producing thin films.

In our experiments we studied the properties of the nickel resistance layer produced with autocatalytic chemical reduction. We established that the electric properties are determined primarily by the following parameters: the pH of the solution, the time of separation and the separation temperature.

The structure of the film varies as a function of the pH of the separation, that is of the phosphorus content of the film; a high (greater than 7 percent) phosphorus content amorphous film is obtained from an acid solution and a low phosphorus content (less than 7 percent) polycrystal film is obtained from an alkaline solution. The structure of the film also determines the electric properties.

The time of the separation determines the thickness of the film and thus the quadratic resistance.

The temperature of the separation influences the separation speed of the film and the phosphorus content.

We studied the behavior of the resistance layers as influenced by heat treatment done at different temperatures. We followed the structural transformations taking place in the course of heat treatment with a transmission electron microscope and with electron diffraction. The resistance curve can be divided into sections in the course of the heat treatment; various processes take place simultaneously in these sections.

In the beginning the resistance decreases. This is the result of a reduction of mechanical tension and a rearrangement of defects. The increasing resistance which follows can be attributed to the effect of oxidation.

The formation of an Ni-P crystalline compound phase begins simultaneous with oxidation; as this becomes predominant the resistance begins to decrease again. This process lasts until the amorphous nickel phase is exhausted on the above processes. The change in the temperature coefficient of the resistance can be explained with these processes as well.

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HUNGARY

PARTS TRADE TASKS OF ELEKTROMODUL DURING CENTRAL ELECTRONICS DEVELOPMENT  
PROGRAM PERIOD

Budapest HIRADASTECHNIKA in Hungarian No 9, Sep 84 pp 391-394

[Article by Gabor Iklody, Elektromodul: "The Parts Trade Tasks of Elektromodul in the Period of the Central Electronics Development Program"; manuscript received 7 Jul 84]

[Text] Summary

The author deals with a theme which represents one of the biggest problems for our electronics industry, the supply of parts. In his article he deals first with the activity of Elektromodul and in the last, evaluating chapter he sums up the lessons of the past and the possibilities for the future. One should stop at each of these findings and think long upon them.

Gabor Iklody

He received his mechanical engineering degree at the Budapest Technical University in 1953. After finishing the university studies he began to work in the Central Experimental Plant which, from 1957 was absorbed into the Mechanical Laboratory. Here he was chief of the production department, chief technologist and chief of the main department for quality control until 1963. Between 1963 and 1973 he was director general of the BRG [Budapest Radio Technology Factory] and from 1973 to the end of 1980 he was director general of the BHG [Beloianisz Telecommunications Factory]. Since 1981 he has been director general of the EMO [Elektromodul Electronic Parts Enterprise]. Up to the end of 1980 he dealt with the organization of equipment development and manufacture. In all three jobs and today as well he has attained noteworthy achievements. A number of foreign and domestic government decorations recognize this activity. Since 1981 he has participated actively in organizing implementation of the EKFP [Central

Electronics Development Program] and in carrying out the not easy task of supplying electronic parts. He is a member of the Presidium and Executive Committee of the HTE [Scientific Association of Telecommunications].

The Elektromodul Hungarian Electrotechnical Parts Trading Enterprise, as its name implies, deals primarily with the export and import of electronic parts and, as a result of its TEK [capital equipment marketing] activity, with the domestic supply of parts.

Total trade in 1983 was 8 billion forints. Of this, trade in active elements came to 4 billion forints, trade in passive elements came to 1.6 billion forints and trade in electromechanical elements came to 2.4 billion forints. This is also a good indication of the division of the several article groups within the enterprise.

Thus, in the classical sense, Elektromodul represents the chief artery for domestic trade in electronic parts. It gathers parts from Hungarian and foreign parts manufacturers and vendors and sells them to Hungarian and foreign users (customers).

Direct operational services and import parts arriving through channels outside the EMO constitute an exception to the classical model. The latter--according to some estimates--reaches 30-40 percent of all electronic parts import.

The task of the EMO would be professional supervision and price work from the viewpoint of assortment adjustment in regard to the parts arriving through other channels (as spare parts, concealed under other article numbers, or simply via authorized parallel foreign trade activity). The EMO cannot satisfy this supervisory role--in the absence of requests. It is to be feared that as a whole the volume of capitalist parts coming into the country is costing more in convertible foreign exchange than it would cost in the event of coordinated or centralized parts import. Despite the 30-40 percent parts import outside of the EMO the chief authorities continue to ask exclusively the EMO for reports, forecasts, trade indicators and even the basic data needed to compile the Seventh 5-Year Plan conception.

It must be kept in mind that the data of the EMO can be used for the taking of industrial policy steps only if the above is taken into consideration.

In the years immediately preceding the EKFP [Central Electronics Development Program] and in the first years of the EKFP (1981-1982) Elektromodul, taking seriously its trade role, worked out a trade-technology strategy adjusted to the situation. This followed logically from the difficulties of parts import and the foreign exchange situation of the country at the time and was interdependent with fulfillment of the EKFP. It aided its realization.



The elements of this strategy follow in greater detail.

#### 1. Maintaining Contact With Manufacturers and Users

In order to satisfy an old and just demand we established technical-customer-service activity and an enterprise information system to chart the shorter and longer range parts problems of equipment manufacturers and the manufacturing-development activity of parts manufacturers and to harmonize the needs and the possibilities. A typical form of this activity, one which will be fundamental in the future, is "bringing together" manufacturers and users in the area of BOAK [equipment-oriented circuits].

Much is said today about equipment-oriented circuits. Perhaps too much. There is no doubt that today virtually every manufacturer of semiconductors has BOAK's made with various technologies and element densities, but the ratio of these is still small compared to catalog circuits. Even optimistic predictions speak of a share of only about 20 percent. This is not to underestimate the significance of BOAK's, but it does mean that this, like everything, has its place within a system. The first thing is to define this place precisely. If it has a place then we must strive to exploit it as economically as possible.

It is still very difficult to estimate the need for BOAK's which can be expected in Hungary. There are several reasons for this. What sort of questions is an equipment designer or manufacturer presented with today?

These include the economy of the product, its reliability, modernness, the market competitiveness and the ability to manufacture the product, etc.

Naturally such a requirement system can be satisfied only if we make similar requirements of parts manufacturers. Another requirement for them is "second sourcing," that is it must be possible to obtain a part from two or more sources. An equipment designer who can use catalog circuits today with great security will turn from this path only if a BOAK offers him something more (in design convenience, in compactness, in reliability or in accessibility).

The subjective factors are still very strong. It is very difficult to believe that microelectronics, which slept for so long like Sleeping Beauty, will be able to realize custom circuits overnight. There can be aid in this only with very good customer service activity by the EMO and, strange as it may sound, with reliable catalog circuits manufactured from the many chips of the MEV [Microelectronics Enterprise].

It is also true that when we talk about equipment-oriented circuits everyone immediately thinks only of monolithic circuits. We are inclined to forget about a technology adopted long ago which promises even greater results. This is hybrid technology. Here, for years, a crucial proportion of the circuits have been made according to customer needs. Even in the case of a small series the manufacture of hybrids can be economical. We must think about maintaining the level of this technology, in fact continually developing it further, because there are still very many unexploited possibilities here for the equipment manufacturers.

There is certainly a need to classify the domestic lines and to divide up the various tasks among different enterprises also in this area. This is all the more important because, as is well known, beginning in the middle of the year the Communications Engineering Cooperative, in addition to the MEV, will operate a line manufacturing gate arrays (which develops the circuits starting from prefabricated wafers). The present needs do not yet use all the manufacturing capacity. So there are plenty of tasks and it can be seen also what great significance coordination and a rational division of labor within the country has. This applies to both development and manufacture.

## 2. Socialist Conversion

It is obvious that in the present foreign exchange situation of the country converting capitalist parts import to the socialist relationship represents one of the chief technical-commercial tasks of the EMO. The EMO assumed this task in time and with a great expenditure of energy. It would do no harm to study in greater detail the reasons for the unexpected slower progress of the conversion process.

--I might sum up the difficulties by saying that today, in Hungary, electronic development is taking place almost exclusively with catalog parts of capitalist origin.

The catalogs and applications descriptions of the larger firms are available to the developers in their own cases, but the product catalogs of socialist firms still count as curiosities.

Samples suitable for development can be obtained from the capitalist firms quickly, often free of charge. But immediate delivery cannot be guaranteed when ordering a few socialist samples.

The Western professional literature, available to everyone, offers developed solutions to many problems. It is not necessary to pay a license fee to use these, so the developer can solve the task without exhausting thought and planning, and with little investment.

There is no socialist equivalent for most of the parts advertised in the Western professional literature, so use of a similar type would require serious redesigning work, which the designers will not undertake.

The material interest of designers is involved here. With the exception of a few areas this is generally linked to preparing the device and not to saving capitalist import. As long as the designer is not directly interested in saving capitalist import one can hardly expect any real improvement in this area.

--Price is a very sensitive theme. Unfortunately the price of many parts of socialist origin is higher than the average price on the capitalist market, and the socialist prices change only very slowly. Of course, this is true of our export too. It is a fact that the users get acquisitions from socialist

countries--products to a large extent--on the basis of the capitalist average price, but the KKM [Ministry of Foreign Trade] and Elektromodul themselves assume 50 percent each of the price difference, thus aiding the use of socialist parts.

--The situation is even worse if we study delivery time limits or the possibilities of getting the necessary quantities. Here we must submit some of our orders to our socialist partners at least one year in advance. At best the necessary quantities must be ensured years in advance with specialization and long term contracts. Unfortunately it is difficult to precisely determine the demand, at the depth of types, 5 years in advance.

A well selected consignment warehouse and the inventory assortment of our enterprise help somewhat in this area.

Despite the difficulties listed in detail above we did achieve the following results in the area of conversion to domestic and socialist sources in 1983:

Product Group	Capitalist Import Replaced					
	Total \$1,000	Percent	Domestic source \$1,000	Percent	Ruble relationship \$1,000	Percent
Electro-mechanical	150	7.8	100	5.2	50	2.6
Passive parts	704	36.5	190	9.8	514	26.7
Active parts	1,073	55.7	9	0.5	1,064	55.2
Total	1,927	100.0	299	15.5	1,628	84.5

It must be noted that very many obstacles deriving from the lack of trade agreements stand in the way of a further acceleration of conversion, so it cannot be increased limitlessly.

### 3. Assortment Adjustment

Elektromodul started a process of standardization and assortment adjustment in 1981 in order to decrease, in a technically supported way and to a logical degree, the assortment of import parts being ordered by user enterprises in an unjustified variety. It is generally recognized that prior to the drastic restriction on capitalist parts import, in the second half of the 1970's, the users ordered from Elektromodul parts from various manufacturers which had similar functions which their designers could simply find in the catalogs on their bookshelves. In 1980, for example, the country used about 4,000 kinds of integrated circuits while the integrated circuit functions needed by the user industry could have been supplied with 800-1,000 well selected types--on the basis of a sober technical analysis. An even stronger type narrowing may have been justified in regard to other parts (for example, electromechanical elements).

It was in this spirit that we published, from January to July 1982, the volumes of the EMO Active, Passive and Electromechanical Assortment Catalog, which had a nice success. As a result of the national response the Program Office of the Ministry of Industry has taken the lead in the assortment adjustment process and the assortment catalog volumes appearing this year will be published under the joint sponsorship of the Program Office of the Ministry of Industry and the manufacturing enterprise, the EMO, after review by the user enterprises.

Thus the assortment adjustment initiated at the EMO from the viewpoint of trade and economicalness has become an organic part of the EKFP. This is illustrated very well if we list the chief goals today of the assortment adjustment work:

--The primary goal of assortment adjustment is to encourage use of parts by domestic manufacture. We are including in our assortment catalogs every domestic part being manufactured or under development which can be called modern.

--Encouraging use of socialist parts is another important goal of our assortment catalogs; this is one of the chief tools of the socialist conversion work, to overcome the difficulties of socialist parts import discussed in the preceding section.

--Our assortment catalogs try in a fundamental way to aid modernization, shifting demand in the direction of parts with a future.

--The centralization of documentation is another important part of assortment adjustment work. Our goal is to make available technical documentation on all selected parts in a form which can be copied and which is suitable for design work, either in the Elektromodul catalog library or at the manufacturing enterprise. This is also true of socialist import parts, which should aid in overcoming the difficulties of socialist parts import.

--In regard to IC's the work of assortment adjustment also has a future task, linked to the EKFP, of offering an increasing number of BOAK's in addition to the standardized catalog IC assortment.

Finally we should devote a few words to the expected effect of assortment adjustment. Naturally it is not possible for an assortment catalog to be enforced by an official decree in Hungary. The enterprises cannot be forced to order exclusively on the basis of the assortment catalogs. To tell the truth, even the EMO gets into trouble from time to time, as we have said already, if, in the case of an order for domestic or socialist types included in the assortment catalogs as an advertisement in good faith, the possibility of supplementary capitalist import acquisition is not available as an "emergency measure." So with the lower price and shorter delivery time, or simply because of immediate service, there remains an "incentive" in the interest of assortment.

Because of the long delivery times for socialist parts already mentioned, there can be short delivery times coupled with conversion to the socialist

relationship only with large scale control stockpiling by the EMO, but at the moment the EMO has few circulating assets. I can certainly say that supplying the EMO with sufficient circulating assets for the above purpose is one of the keys to the success of the electronics program of the Seventh 5-Year Plan.

#### 4. In Conclusion I Call Attention to a Few Problems Affecting Industrial Policy

The original goals of the EKFP in regard to parts have not been met. There are still no completed investments. As a result, on the one hand, supply from domestic to domestic is not developing according to expectations and, on the other hand, there is not a sufficient and appropriate commodity base for the socialist barter trade intended to balance the existing parts lines--for example, the shortage of Kontakta, Remix, HAGY [Telecommunications Materials Factory] and KOPORC parts. Because of this, when seeking someone ready to deliver, we are forced to pay for parts import with finished products or other primary materials.

The level of socialist parts barter is now so low that if we were to realize--investing all our efforts--a 30 percent per year increase in socialist parts import, the distribution of socialist-capitalist import would still not be acceptable for years.

So, if we want to maintain the annual 12-14-percent development pace now dictated by our equipment manufacturers the parts cover for this can be ensured only by increasing capitalist import--however sad it is to say it. And there is no foreign exchange cover for this, and obviously will not be either. In recent years the enterprise reference allotments centralized at the EMO have decreased by about 10 percent per year even in absolute value. Taking into consideration the devaluation resulting from price increases we can talk about an annual 20 percent reduction in capitalist import possibilities. It is not probable that this trend will turn around in the year ahead.

What follows from this? We must reckon with an undesired, forced decline in the development dynamics of the equipment manufacturing industry.

One thing is certain. Socialist import will not increase suddenly, an improvement in domestic deliveries is not probable, the time limits for capitalist acquisition are several times what they were earlier, and their prices are showing an upward trend. So tension is increasing from the supply side and from the viewpoint of Elektromodul I cannot say anything reassuring to the technical public opinion of the country about parts supply for the equipment manufacturing industry.

8984

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HUNGARY

# ELECTRONIC PARTS ARE OBJECT OF CONCERN

Budapest HIRADASTECHNIKA in Hungarian No 10, Oct 84 pp 433-434

[Editorial by editor-in-chief Dr Gyula Tofalvi: "I Think. . . ."]

[Text] I think that I must answer those dear readers who have asked:

"Why has so much emphasis been given in our journal to this year's parts conference of the Communications Engineering Scientific Association?" and

"Why have we devoted a double issue to the theme of electronic parts when there was never an example of this in past years?"

The answer is extraordinarily simple. As Lajos Koveskuti, president of our association, wrote in the September issue of our journal we really intended to honor the work done at the parts conference of our scientific association held in Pecs in 1974 and the "Proposal" which was born in the wake of it.

This really was the occasion and the motive! But let me ask those who question it: Might we not have had another reason to publish a special issue, even a double special issue, to describe the work, achievements, aspirations and primarily the problems of our electronic parts industry?

I must frankly confess that going beyond honoring a tenth anniversary I also had a number of thoughts which aided the decision as a result of which the double issue finally appeared.

What were these thoughts?

--I think that never before was it so justified to put the absolute necessity of a stressed development of our electronic parts industry in the center of our thoughts as it is today when we are struggling with parts supply problems an example of which can hardly be found in past years.

--Going beyond the pleasure at and recognition of the nice results achieved in the area of MOS equipment-oriented circuits, foil, layer and electrolytic condensers, strontium ferrites, metal layer resistors and hybrid circuits, the Sixth 5-Year Plan period of the Central Electronics Development Program was a

disappointment to me in the area of bipolar circuits, passive, electromechanical, vacuum technology and structural parts and in the supply of parts.

The EKFP [Central Electronics Development Program] brought a solution in only a few areas instead of having a comprehensive, backwardness liquidating, swift, etc. character.

I make no secret of the fact that for me even the magnificence of the results achieved was eclipsed by the parts supply problems which developed at the end of the Sixth 5-Year Plan.

--For me the essence of the problem is concentrated in the fact that even with the creation of the Central Electronics Development Program a parts supply situation developed in our electronics industry by the end of the Sixth 5-Year Plan which was much worse than it was at the beginning of the Sixth 5-Year Plan. It is true that the EKFP was not the cause of the decline, but it is also true that it could offer no protection in the situation which developed. In addition it is true that the EKFP was effective only in some theme areas and that its protraction in time and the unequal development of "supply and demand" contributed to the problems. I know that the problems appearing in the area of parts supply today are a direct consequence of the fact that in the past decade we did not develop our parts industry with a suitable dynamic and the development of it gradually fell behind year by year, in regard to both the international level and the development of domestic needs. The supply problems are attested to by the import allocation management which was introduced and then formally ended, one of the chief characteristics of which was that it could not provide a solution.

Our supply problems will be increased even further in the future by the needs of parts users outside of industry, which will increase in the second half of the 1980's even more dynamically as compared to the development of our electronics industry. If we add to this the spread of electronics in the domestic economy which is supposed to be started in the Seventh 5-Year Plan then we can see that the national parts needs will increase more quickly than ever before.

--In the wake of the everyday problems of the Sixth 5-Year Plan it is proven to me many times over that a parts industry program based exclusively on the possibility of the parts manufacturing enterprises cannot bring a solution! It can bring only additional serious backwardness! I did not desire this repeated experience, because the experts formulated it more than a decade ago, at Pecs as well.

It has been repeatedly proven to me also that state intervention and state aid, guaranteeing a solution, are indispensable for the desired development of the electronics background industry and for a swift liquidation of the backwardness which has developed.

Knowing the work that has been done thus far on industrial concepts for the Seventh 5-Year Plan it is to be feared that once again this recognition will

not become a decisive factor in the new programs being prepared for the Seventh 5-Year Plan either. If this should be so it will result in unforeseeable consequences in our entire electronics industry.

--Finally only a few questions which again argue that the problems of our parts industry should be put on the agenda only after they are answered:

Did we achieve the goal which we formulated at Pecs in 1974? Did we realize the program which we recommended to the party in our "Proposal" after the Pecs parts conference and which we judge to be indispensable even today? Will we be able to give an accounting to ourselves tomorrow if we stop, if in the wake of the difficulties we judge to be insoluble even what can be solved?

I know that a number of scientific articles are "parked" in the printer, as standing material, which are significant even internationally and report on scientific achievements and have not received room in our journal for a number of issues. I know, but I also know that today the parts industry situation has become the "forward or backward" question in the Hungarian electronics industry, whereas the "parked" articles will result at most in a minor delay of a bit of praise.

Bits of praise are needed too! Indeed! But if we must rank them in first, second or n'th place, priority goes to our parts industry problems.

And finally one question more:

What are these bits of praise worth and how long will they last if we do not solve the serious problems of our electronic parts industry?

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HUNGARY

## TWENTY-YEAR DEVELOPMENT OF ATSZ-K

Budapest HIRADASTECHNIKA in Hungarian No 10, Oct 84 pp 474-476

[Article by Sandor Szilagyi, BHG Development Institute: "The 20 Year Development of the ATSz-K"; manuscript received 24 Mar 84]

### [Excerpts] Summary

The BHG [Beloianisz Telecommunications Factory] Communications Engineering Enterprise began to take over the ATSz-K 100/2000 model telephone exchange system 20 years ago. In the period which has elapsed the developers of the BHG have significantly developed the equipment. The product makes up one third of the annual production value of the enterprise. Microprocessor technology will be used for a further modernization of it.

### Future of ATSz-K Development

Development requires that industry switch within a short time to the manufacture of electronic, digital switching systems which will surpass the systems manufactured now, largely electromechanical systems, from the viewpoint of both manufacturing and operational conditions. But to be able to bear the burdens and shocks of conversion there will be a need for reliable, large volume products which will ensure the viability of the factory until the new systems are ready. The ATSz-K 100/2000 system, which makes up about one third of the production of the BHG and for which--according to our customers--there will be an unchanged volume of demand up to the end of the decade, is suitable for this role.

But the conversion which can be expected in the decade ahead cannot be imagined from one day to the next, so a further development of the system is always timely. Taking into consideration the 25-40-year life expectancy of the ATSz-K exchanges, we want to participate in the work which is aimed at rationalizing and centralizing the maintenance of installed and operating exchanges. We have as a goal the beginning of the manufacture of these so-called central operational control systems in the course of the next 5-year plan.

The development of outgoing long-distance registers for automatic long-distance calls from rural networks is about completed; in the course of this we have introduced a microprocessor among the basic devices used in the system for the

first time. Today the life expectancy of the system is limited by those moving electromechanical elements whose wear or erosion is greatest, and whose regular replacement cannot be solved because of the large number of use sites.

A feasible path seems to be the electronicalization of those circuits in which the phenomenon described appears most strongly--registers and markers. With the present development of microelectronics we are close to achieving solutions which, as the result of the high degree of decentralization of control, will make it possible to exploit the reliability and life expectancy of electronic elements many times over.

#### Conclusions

The past 20 years have provided ample successes and difficulties, lessons and experiences in the course of the development and manufacture of the ATSz-K. The product has proven itself; they are exported today in quantities never seen before and the Hungarian exchanges have a good reputation from Uzhgorod to Kamchatka. Their future will involve expansion, operational control systems and replacement of worn out relay circuits with electronics, microprocessor solutions.

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END